American Journal of Public Health
and THE NATION'S HEALTH

Volume 29 March, 1939 Number 3

Diphtheria Immunization With Fluid Toxoid and Alum Precipitated Toxoid*

Preliminary Report

VLADIMIR K. VOLK, M.D., D.P.H., F.A.P.H.A., AND
WILLIAM EDWARD BUNNEY, PH.D., F.A.P.H.A. †

THE studies were planned to investigate the height and duration of the antitoxic immunity following immunization with fluid and alum precipitated diphtheria toxoid. Conflicting reports [1, 2, 3, 4] on the comparative values of these two antigens made such a study seem important. We present a comparison of results from 1 dose of alum precipitated toxoid and 2 doses of fluid toxoid at 4 months, 1 year, and 2 years after injection; and a comparison of 2 doses of alum precipitated toxoid and 3 doses of fluid toxoid at 4 months after injection.

METHODS

The study is being carried out on free-living children primarily from rural schools in Saginaw County, a county of about 1,110 square miles. A total of 1,800 children are included in the report. The following procedures were used in immunization:

1. 1 injection of fluid toxoid
2. 2 injections of fluid toxoid (2 weeks apart)
3. 2 injections of fluid toxoid (3 weeks apart)
4. 3 injections of fluid toxoid (3 weeks apart)
5. 1 injection of alum precipitated toxoid
6. 2 injections of alum precipitated toxoid (3 weeks apart)

In addition a group of unselected children who received no injection were blood titrated at the end of 4 and 12 months. In a strictly controlled group alternate children in each school received the 2 immunizing agents. In this way 2 doses of fluid and 1 of alum precipitated toxoid were compared in some schools, and 3 doses of fluid compared with 2 doses of alum precipitated toxoid in other schools. The results from these controlled groups are analyzed separately as well as combined

* These studies are being carried out under a grant from the American Public Health Association and the U. S. Public Health Service, in coöperation with the Saginaw County Health Department and the Michigan State Department of Health. Read before the Joint Session of the Laboratory and Epidemiology Sections of the American Public Health Association at its Sixty-seventh Annual Meeting in Kansas City, Mo., on October 27, 1938.

† With the technical assistance of Anita Leavitt, Ann Sonderman and Louise Hagaman.

with the results obtained when alternate schools received the 2 immunizing agents. The schools included in the investigation number 110.

It was decided to follow the immunity response by blood titrations only. The Schick test was not used because of the well known fact that the Schick test itself has an antigenic effect, especially when given to a child already having antitoxin circulating in its blood. Therefore, before giving immunizing treatment, 4–5 ml. of blood were taken from the children. The children were bled again in 4 months and 12 months, and will be bled every 12 months thereafter for the duration of the study so that not only the height of the antitoxin level but the relative permanence of that level will be determined. A 1 ml. injection of the fluid or alum precipitated toxoid was given subcutaneously in the upper arm. Whenever a second or a third injection was given, a 3 weeks' interval usually elapsed between the injections. A small group was given injections with a 2 weeks' interval.

The toxoid used was obtained from a commercial firm by Dr. W. T. Harrison of the National Institute of Health. It was felt advisable to use such a product because it was widely available. The alum precipitated toxoid was prepared from the fluid toxoid used in the study. This was felt to be important because of the possibility that two different preparations of toxoid might vary in some intrinsic antigenic efficacy for which we have no method of determination. The preparation used had a high average potency. The National Institute of Health tests showed 20 L_f/ml., and the alum precipitated toxoid to stimulate production of an average of 2–4 units of antitoxin in guinea pigs in the National Institute of Health control tests for alum precipitated toxoid. On the re-solution of the alum precipitated toxoid it was likewise found to have 20 L_f/ml.

RESULTS

Of the 1,800 children, 358, or 20 per cent, had titratable antitoxin (.001 unit or more per ml.) in their circulating blood at the time of the first injection

TABLE I

Age Distribution of Children in the Study

Age	*1 A. P.*	*2 A. P.*	*1 Fluid*	*2 Fluid*	*3 Fluid*	*Titration (No Toxoid)*	*Total*
8 Mos.	1	1	1	..	..	..	3
1 Yr.	2	5	..	1	..	..	8
1½ Yr.	2	2	..	2	..	..	6
2	1	2	2	2	1	1	9
3	8	3	2	5	3	2	23
4	37	13	2	10	9	1	72
5	97	60	15	38	41	2	253
Total	148	86	22	58	54	6	374—20.8%
6	156	98	15	94	82	..	445
7	146	59	7	60	49	3	324
8	101	35	8	18	40	4	206
9	73	32	4	22	29	..	160
10	41	25	5	22	22	2	117
Total	517	249	39	216	222	9	1,252—70. %
11	14	6	..	16	19	..	55
12	15	9	1	16	13	..	54
13	8	8	1	11	13	1	42
14	4	2	1	5	7	..	19
15	..	..	1	1	2	..	4
Total	41	25	4	49	54	1	174— 9.2%
Grand Total	706	360	65	323	330	10	1,800

of antigen. The majority showed a marked rise in antitoxin content following the injections and of course are not included in the results analyzed in this report. This leaves 1,442 children with less than .001 unit of antitoxin at the time of the first injection, and this paper is concerned with a comparison of the antitoxin levels in these children following the different methods of immunization described.

Table I shows the age distribution of the 1,800 children. Of these, 374 or about 28 per cent, are of preschool age; 1,252, or 70 per cent, are between the ages of 6 and 10; and 174, or 9.2 per cent are between the ages of 11 and 15. Included are 201 cases from Genesee County, studied in coöperation with Dr. L. V. Burkett, Genesee County Health Commissioner, Flint, Mich.

As stated, part of the children were in a strictly controlled group with each alternate child receiving different immunizing procedures. These results are entered in Table II under "controlled." For the rest of the children the two immunizing agents were given in alternate schools. This group is classified as "uncontrolled" in Table II. It is evident that the results in the two groups are strictly comparable. The number of children developing .001 unit or more of antitoxin is made the basis of analysis in this table. The two groups proved equally comparable when .01 or 0.1 unit was the basis of comparison. To conserve space, analyses at these levels are not included here. Since the "controlled" and "uncontrolled" groups are comparable, the results from the two groups are pooled in the remainder of the report to simplify presentation.

Table III shows the comparison of the antitoxin response of the children to different immunizing procedures. Of the children who received no immunizing injection 11 per cent developed antitoxin at the end of 4 or 12 months. This is rather high for a community with the low carrier rate (see later) we have found in Saginaw County. However, all of these children merely changed from less than .001 to .001 unit and may very well represent only the degree of unreliability of the titrations at this low level. The group that received one injection of fluid toxoid responded very poorly by the end of 10 days and the antitoxic response was still low at the end of 4 and 12 months.

The group that received one injection of alum precipitated toxoid also responded very poorly at the end of 10 days, having 27 per cent with .001 or more units of antitoxin.

One hundred and sixty children who received 2 injections of fluid toxoid at 3 week intervals showed an antitoxic

TABLE II

Comparison of Antitoxin Response to the Different Immunizing Procedure in Controlled and Uncontrolled Groups

(Antitoxin level at time of 1st injection <.001)

Immunizing Preparation and Procedure	*Group*	*4 Months*			*12 Months*		
		No. in Group	*Children With .001 or More*		*No. in Group*	*Children With .001 or More*	
			No.	*%*		*No.*	*%*
2 injections fluid	Controlled	129	82	63.5	88	55	62.5
3 wk. interval	Uncontrolled	31	20	64.5	23	12	52.1
1 injection A. P.	Controlled	116	105	90.5	101	86	85.1
	Uncontrolled	236	222	94.0	226	199	88.0
3 injections fluid	Controlled	113	113	100.0	..	..	....
3 wk. apart	Uncontrolled	49	46	93.8	49	47	95.9
2 injections A. P.	Controlled	138	138	100.0	..	..	....
3 wk. apart	Uncontrolled	10	10	100.0	..	..	....

TABLE III

Comparison of Antitoxin Response to the Different Immunizing Procedures (All cases <.001 antitoxin level at primary titration)

Immunizing Procedure	10 Days: No. in Group	10 Days: Children With .001 or More: No.	10 Days: Children With .001 or More: %	4 Months: No. in Group	4 Months: Children With .001 or More: No.	4 Months: Children With .001 or More: %	12 Months: No. in Group	12 Months: Children With .001 or More: No.	12 Months: Children With .001 or More: %	18 Months: No. in Group	18 Months: Children With .001 or More: No.	18 Months: Children With .001 or More: %	24 Months: No. in Group	24 Months: Children With .001 or More: No.	24 Months: Children With .001 or More: %
No injection	..	..	....	61	6	11.5	19	2	10.5	..	..	....	..	..	....
1 injection Fluid	86	18	20.9	12	2	16.6	10	2	20.0	..	..	....	..	..	....
2 injections Fluid 2 wk. apart	..	..	....	14	12	85.6	15	9	60.0	..	..	....	13	6	46.1
2 injections Fluid 3 wk. apart	..	..	....	160	103	64.4	111	67	60.4	9	4	44.4	..	..	....
1 injection A. P.	80	22	27.5	352	327	93.0	327	285	87.3	19	15	79.0	152	118	77.6
3 injections Fluid 3 wk. apart	..	..	....	162	159	98.1	49	47	96.0	..	..	....	..	..	....
2 injections A. P. 3 wk. apart	..	..	....	148	148	100.0	..	..	....	..	..	....	..	..	....

response in 64 per cent at the end of 4 months. This percentage was reduced to 60 per cent at the end of 12 months, and 45 per cent at the end of 18 months.

For comparison the antitoxic response may be noted when the interval was reduced to 2 weeks. The figures indicate that 85 per cent showed a response at the end of 4 months, 60 per cent at the end of 12 months, and even 46 per cent at the end of 24 months. The difference between these and the 3 week interval results is not statistically significant with the numbers concerned.

Better response was observed in the group of 352 children who received one injection of alum precipitated toxoid. In this group 93 per cent showed an increase in antibody at the end of 4 months. As time went on some loss of antitoxin was noticed, although 75.7 per cent still maintained the increased antitoxin level at the end of 2 years. The difference between these and the 2 fluid toxoid injection results is statistically significant and can be considered as proved under the conditions of this study.

Of 162 children who received 3 injections of fluid toxoid at 3 week intervals, 98 per cent showed an increase in circulating antitoxin at the end of 4 months, and 96 per cent at the end of 12 months.

Of 148 children who received 2 injec-

TABLE IV

Comparison of Antitoxin Levels 10 Days After a Single Injection of Fluid or A. P. Toxoid in Children Having <.001 at Time of Injection

	Units of Antitoxin per 1 ml. of Serum: <.001 No.	<.001 %	.001<.004 No.	.001<.004 %	.004<.01 No.	.004<.01 %	.01<.04 No.	.01<.04 %	.04<.1 No.	.04<.1 %	.1 plus No.	.1 plus %	Total Number
10 days after one injection of fluid	68	79.0	6	7.0	..	....	1	1.0	3	4	8	9.0	86
10 days after one injection of A. P.	58	72.5	6	7.5	..	....	1	1.3	..	....	15	18.7	80

TABLE V

Comparison of Antitoxin Levels 10 Days After One Injection of Fluid or A. P. Toxoid in Children Having <.001 Unit or More

Kind of Toxoid	No. of Cases	Units of Antitoxin per ml. of Serum		Number at Time of 1st Injection	Number 10 Days Later
Fluid	41	<.001			3
		.001	<.004	9	0
		.004	<.01	3	0
		.01	<.04	7	0
		.04	<.1	6	0
		.1 plus		16	38
Alum precipitated	30	<.001			1
		.001	<.004	6	0
		.004	<.01	3	0
		.01	<.04	8	0
		.04	<.1	6	0
		.1 plus		7	29

tions of alum precipitated toxoid and who were followed for a period of 4 months only, 100 per cent showed an antitoxin response within 4 months. Twelve months have not elapsed since the last injection.

Table IV shows the antitoxin response at the end of 10 days after a single injection of either fluid or alum precipitated toxoid. Those receiving fluid toxoid who did not have titratable antitoxin to start with showed an increase in 21 per cent only, although it can be seen from the table that some show a surprisingly high rise in antitoxin level. Groups which received alum precipitated toxoid injections showed an increase in antitoxin in 28 per cent of the children at the end of 10 days.

A group of children who had more than .001 unit of antitoxin demonstrated prompt response to antigenic stimulation. This can be seen in Table V. These results are interesting because of the frequent questions as to the advisability of giving immunizing injections after exposure. In cases of exposure to diphtheria it might be a very desirable procedure to give some kind of antigen to children. Of the 4 chil-

TABLE VI

Distribution of Antitoxin Levels After Various Immunizing Procedures and Following Different Intervals

(All children having <.001 unit before injection)

		Units of Antitoxin per ml. of Serum											
		<.001		.001<.004		.004<.01		.01<.04		.04<.1		.1 plus	
No. of Cases	Time of Titration	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Antitoxin Response from Two Doses of Fluid Toxoid, 3 Weeks Apart													
160	4 months	57	35.6	26	16.2	24	15.0	23	14.4	12	7.5	18	11.3
111	12 months	44	39.7	25	22.5	11	9.9	20	18.0	2	1.8	9	8.1
9	18 months	5	55.6	1	11.1	0	0.0	2	22.2	0	0.0	1	11.1
Antitoxin Response to One Dose Alum Precipitated Toxoid													
352	4 months	25	7.1	68	19.3	58	16.5	96	27.2	46	13.1	59	16.8
327	12 months	42	12.8	69	21.1	61	18.7	107	32.7	18	5.5	30	9.2
19	18 months	4	21.0	4	21.0	4	21.0	6	31.8	1	5.2	0	0.0
152	24 months	34	22.4	33	21.7	28	18.4	35	24.0	9	5 9	13	8.6
Antitoxin Response to Three Doses of Fluid Toxoid 3 Weeks Interval													
162	4 months	3	1.9	13	8.0	24	14.8	52	32.1	29	17.9	41	25.3
49	12 months	2	4.1	4	8.2	5	10.2	16	32.6	12	24.5	10	20.4
Antitoxin Response to Two Doses of A. P. Toxoid 3 Weeks Interval													
148	4 months	0	0.0	2	1.4	4	2.7	21	14.2	41	27.7	80	54.0

dren who failed to show an increase in antitoxin, 3 had a titer of less than .002 unit and 1 a titer of .004 unit per ml. before injection. Whether these represent a negative phase or the unreliability of titrations at this low level of antitoxin cannot be said. This phase of the problem is receiving further detailed study.

Table VI shows the actual antitoxin levels achieved at different intervals following the several immunizing procedures. It is evident that a procedure which causes more children to develop an appreciable antitoxin titer also produces more with antitoxin in higher concentrations.

In our series of 360 children receiving 2 injections of alum precipitated toxoid, we observed no reactions indicative of sensitivity following the second injection. It is indeed suggestive that 2 injections of alum precipitated toxoid produce the highest antitoxin level of all procedures tried. As we started this group in the spring, we are not in a position to present observations for longer than 4 months.

Table VII shows a comparison of response in preschool and school children receiving one injection of alum precipitated toxoid and fluid toxoid. There may be a tendency for the preschool children to show a better response to the immunizing treatment than the school children but the figures are not large enough for the differences to be significant. Further work is being done on this point.

In addition to following the immunity response, a continual diphtheria carrier survey is being carried on in the schools. Throat cultures are taken from all the school children irrespective of whether they have received toxoid or not. This is felt to be essential for the intelligent evaluation of the immunizing results obtained because one might expect a much higher antitoxin response in a locality with a high carrier rate of virulent diphtheria organisms and a lower response in a locality where

TABLE VII

Comparison of Antitoxin Response in Preschool and School Age Groups Having <.001 at Time of Injection

		4 Months			12 Months			24 Months		
			Children With .001 or More			Children With .001 or More			Children With .001 or More	
Immunizing Procedure	*Age Group*	*No. in Group*	*No.*	*%*	*No. in Group*	*No.*	*%*	*No. in Group*	*No.*	*%*
1 injection	5 yrs. and under	63	61	96.8	59	53	89.9	33	28	84.8
A. P. toxoid	6 yrs. and over	316	292	92.4	268	232	86.6	..	..	....
2 injections	5 yrs. and under	29	19	65.5	12	9	75.0	..	..	....
Fluid toxoid	6 yrs. and over	131	84	64.2	99	58	58.6	..	..	....

TABLE VIII

Saginaw County Diphtheria Carrier Survey

			No. of Positive KL					
			Pathog.		Non Pathog.		No Virulence Test Made	
Year	*No. of Cultures Taken*	*Per cent Pos. KL*	*No.*	*%*	*No.*	*%*	*No.*	*%*
1936	3,522	.4	8	.23	3	.09	3	.09
1937	6,636	.5	14	.21	14	.21	6	.09
1938	9,188	.37	9	.1	21	.23	5	.05
Total	19,346	.42	31	.16	38	.2	14	.07

exposure to virulent diphtheria organisms is a rarity.[5] An attempt is being made to take throat cultures at regular intervals during the months of highest morbidity rate. Every positive culture is now being examined for virulence and the child is tested repeatedly as long as it remains a carrier. Of the 19,346 throat cultures taken 83 were found KL positive, of whom 31 were found virulent (see Table VIII). The antitoxin level of all diphtheria carriers is determined at frequent intervals in order to evaluate influences of harbored diphtheria bacilli on the immunity response of the child.

The diphtheria carrier survey covered 119 schools, and 7,347 children were cultured.

DISCUSSION

This paper is concerned solely with the antitoxin response to different immunizing procedures. No attempt is made to prove that any one procedure is the procedure of choice for routine immunization against diphtheria, and for two reasons: (1) The ultimate basis for the evaluation of any immunization method is whether or not it protects against diphtheria, and not necessarily whether or not it confers Schick negativity or raises the antitoxin level to any definite point; (2) It is entirely possible that a procedure which results in a lower level of antitoxin than some other may still be the method of choice from the public health standpoint. That is, it might be less expensive, be easier to administer, and confer a high enough percentage of immunity to be the most efficient use of the public health dollar in prevention of diphtheria. It may be a question of striking a balance between the conferring of the highest possible immunity to the individual on the one hand, and the reduction of diphtheria by conferring a lower but sufficient level of immunity to the community as a whole on the other.

The fact that no abscesses or severe reactions have followed the 2 injections of alum precipitated toxoid augurs well for the future of this method of immunization.

In most studies of a diphtheria immunizing procedure the Schick test is used. On the other hand, in much of the routine immunization a pre-Schick test is not used and probably will be used less and less in the future as preschool immunization increases. Thus, since the Schick test may possibly have an antigenic effect, it becomes important from the practical point of view to evaluate diphtheria immunization in the absence of the Schick test, as done in this study.

FitzGerald, et al.[6] report a better antitoxin response to 3 doses of fluid toxoid than to 2 injections of alum precipitated toxoid, just the opposite of our results. There is no significant difference between their results and ours with 2 doses of alum precipitated toxoid. There is a significant difference between their results and ours with 3 injections of fluid toxoid, our results being definitely lower than theirs. Perhaps this is due to a difference in the toxoids used, but it may be unsound to compare their fluid toxoid results with ours or with their own alum precipitated toxoid results since their 3 dose fluid toxoid results are based on those children who were originally Schick positive and not on the basis of those who had originally no titratable antitoxin. In other words, in contrast to their other groups (and to ours) their 3 dose fluid toxoid group had the benefit of the stimulus from a Schick test, and also might perhaps have contained some children who gave positive Schick tests but had titratable antitoxin below the .01 unit level and so would give marked response to any immunizing procedure. on the other hand, Fraser and Halpern [3] in a study of 32 children observed a similar high response to 3 injections of

fluid toxoid. Here again some of the children received a pre-Schick test but all were titrated for antitoxin content before injection making the conditions more comparable to ours. Perhaps these latter results do point to some undetermined difference in the fluid toxoids used. It is conceivable that different technics or environments influence the results but one might expect these factors also to effect a difference in the alum precipitated toxoid results.

SUMMARY

The antitoxin response of children to several diphtheria immunization procedures has been determined. In the increasing order of the response they induce, they are, under the conditions of our study: 1 dose fluid toxoid, 2 doses of fluid toxoid at 3 week interval, 1 dose of alum precipitated toxoid, 3 doses of fluid toxoid at 3 week interval, and 2 doses of alum precipitated toxoid at 3 week interval.

REFERENCES

1. Wells, D. M., Graham, A. H., and Havens, L. C. *A.J.P.H.*, 22:648–650 (June), 1932.
2. Graham, A. H., Murphree, L. R., and Gill, D. G. *J.A.M.A.*, 100:1096–7 (Apr.), 1933.
3. Fraser, D. T., and Halpern, K. C. *Canad. Pub. Health J.*, 26:469 (Oct.), 1935.
4. Straus, H. W. *J. Lab. & Clin. Med.*, 22:893 (June), 1937.
5. Jensen, Claus. *Proc. Roy. Soc. Med.*, 30:71 102 (July), 1937.
6. FitzGerald, J. G., Fraser, D. T., McKinnon, N. E., and Ross, M. A. *Bull. New York Acad. Med.*, 14:566 (Sept.), 1938.

Tribute to a Public-Spirited Physician

Legend on a Memorial Statue, St. Paul's Cathedral, London, England

William Babington, M.D., F.R.S., Fellow of the Royal College of Physicians, born May 21, 1756, died April 29, 1833.

"Eminently distinguished for science, beloved for the simplicity of his manners and the benevolence of his heart, respected for his inflexible integrity and his pure and unaffected piety. In all the relations of his professional life he was sagacious, candid, diligent and humane; firm in his purpose, gentle in execution; justly confident in his own judgment, yet generously open to the opinion of others. Liberal and indulgent to his brethren but ever mindful of his duty to the public.

"To record their admiration of so rare a union of intellectual excellence and moral worth and to extend to future generations the salutary influence which his living example can no longer diffuse, this monument has been erected by the public subscription of his contemporaries. A.D. 1837."

Asbestosis*

R. R. SAYERS, M.D., F.A.P.H.A., AND
W. C. DREESSEN, M.D.

Senior Surgeon, and Passed Assistant Surgeon, U. S. Public Health Service, Washington, D. C.

ASBESTOS is well adapted for use as a textile material because of its fibrous nature. On account of this, as well as its non-combustible and excellent insulating properties, it has come to be used in ever increasing quantities during the past 20 years. Hence, it is not surprising that Gloyne and Merewether [1] should refer to pulmonary asbestosis as a "modern disease."

The first record of a case of asbestosis seems to have been made by Montague Murray in 1900. The first complete description of the disease and of the "curious bodies" seen in lung tissue and sputum appeared in 1927 when Cooke [2] and McDonald [3] reported 2 cases of asbestosis and listed their reasons for believing that asbestosis bodies originate from asbestos fibers that reach the lungs. Their papers aroused general interest in the subject and numerous others appeared soon afterward. Hoffman [4] appears to have been the first American to call attention to the magnitude of the asbestosis problem. In 1918 he reported that 13 deaths from asbestosis had occurred among asbestos textile workers, and about the same time Pancoast, Miller, and Landis [5] reported on 17 cases of asbestosis. Mills's [6] paper was the first pathological report on asbestosis published in the United States, and in the same year, 1930, Lynch and Smith [7] reported on asbestosis bodies found in the sputum of asbestos workers.

The Public Health Service was requested by the State Board of Health and the Industrial Commission (Administrator of the Workmen's Compensation Act) of North Carolina to assist them in making an engineering and medical study of the health hazards in the asbestos textile industry of that state. The objectives of this study were:

1. To make a medical study of the effects of long-continued inhalation of asbestos dust on the human body.
2. To identify the manufacturing processes that create dust, and to recommend practices for reducing the dust exposure of workers.
3. To find out what concentrations of asbestos dust can be tolerated without injury.

It is the purpose of this paper to review briefly the principal findings of this study.[8]

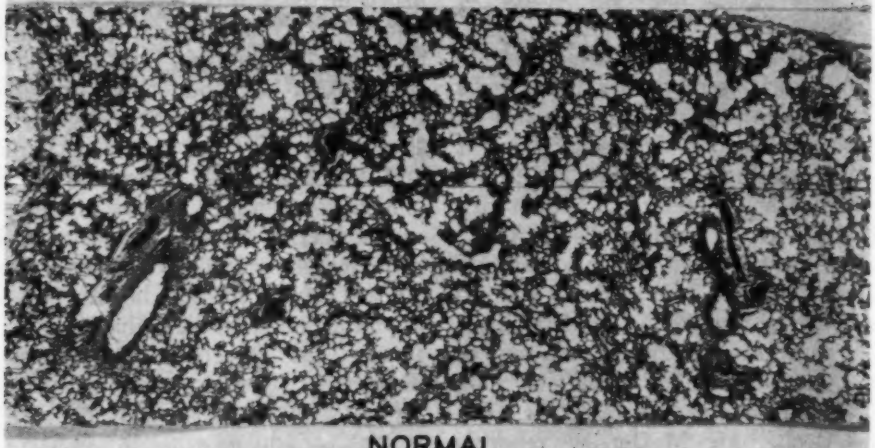
ENGINEERING FINDINGS

The main asbestos raw material used for textiles is Canadian chrysotile, which is a hydrated magnesium silicate containing no quartz.

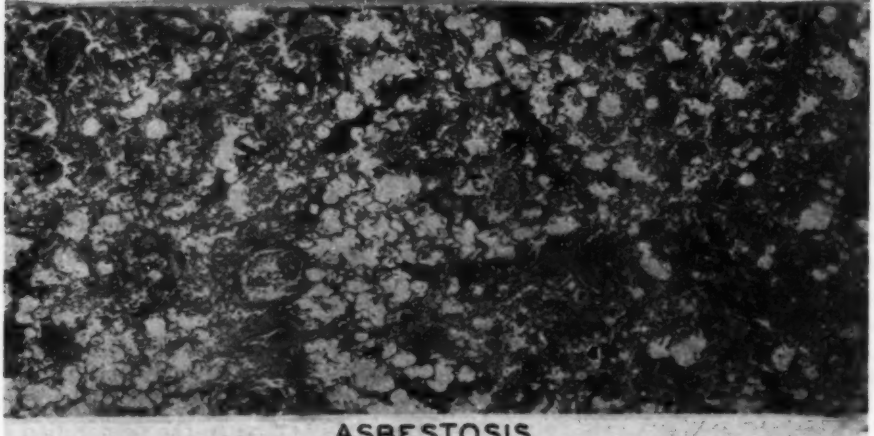
The textile manipulations of asbestos are very similar to the production of cotton or woolen goods. The crude fiber is sent first to the preparation department, then, in the order named, to the carding machines, spinning frames, winding bobbins, twisting ma-

* Read before the Industrial Hygiene Section of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 28, 1938.

SILICOSIS



NORMAL



ASBESTOSIS

FIGURE I—Photomicrographs of Lung Sections Showing the Presence of Nodular Fibrosis and Emphysema in a Silicotic Lung and Diffuse Fibrosis and Emphysema in an Asbestotic Lung. A Section of a Normal Lung Is Shown for Comparison. Magnification 16 X.

TABLE I

Summary of Results Showing the Exposure of Asbestos Textile Workers Under Controlled and Uncontrolled Working Conditions

Equipment	Number of Duct Connections	Volume of Air Handled (CFM)	Dust Concentration With Exhaust (MPPCF)	Dust Concentration Without Exhaust
Willowing (opening)	* 2	625–1,000	3.6	11.1–36.0
Piling †	1	1,025	2.0	5.4
Picking	3	2,570	6.7	34.3–74.3
Carding (primary)	3	1,420	2.0	72.3
Carding (roving)	4	1,440		
Spooling	‡ 1	46.5	2.9	13.1
Weaving (broadloom)	2	1,300	.7	4.7–49.7
Brusher calenderer	3	1,650	1.0	11.1

* Equipped with pneumatic conveyor.
† Exhausted bin or compartment.
‡ Individual cone for each spool and connected to exhaust manifold.

chines, spooling frames, and finally to the looms and miscellaneous fabricating devices.

In all, 242 dust counts were made in estimating the exposure of these asbestos workers. Only summary engineering findings, or dust concentrations as they relate to medical findings, will be discussed. Summarized results of dust concentrations under controlled and uncontrolled conditions appear in Table I. It will be noted that 74.3 million particles per cubic foot (m.p.p.c.f.) is the maximum concentration of dust encountered. Even this maximum figure is much lower than is frequently encountered in other siliceous trades where it has not been uncommon to encounter maximum dust concentrations of 1,000 m.p.p.c.f.

The dust in asbestos plants is made up of particulate matter and fibers. The median size in microns of particulate matter ranged from 1.85 to 2.40. Particles were smallest in the carding and preparation processes, and largest in weaving. The median length of fibers in microns ranged from 7 to 16.3. As might be expected, the longest (400 μ) were noted in case of weaving and the shortest in preparation.

TABLE II

Median Length of Fibers Sampled With an Owens Jet Apparatus

Activity	Median Length of Fibers in Microns
Willowing	7.0
Picking	9.5
Carding	8.8
Twisting	12.8
Weaving (broadloom)	16.3

TABLE III

Size Frequency Distribution of Particulate Dust Suspended in the Air of Asbestos Textile Plants

Nature of Process Where Sample Was Taken	Median Size (in Microns)	Geometric Standard Deviation	Percentage Frequency of Each Particle Size Group (in Microns) 0 to 0.49	0.5 to 0.99	1 to 1.49	1.5 to 1.99	2 to 2.49	2.5 to 2.99	3 to 3.49	3.5 to 3.99	4 to 4.49	4.5 to 4.99	5 or More	Total
Preparation	1.85	1.56	3	21	37	22	10	4	2	1	0	0	0	100
Carding	1.35	1.57	1	9	24	25	9	16	4	5	1	3	3	100
Mule spinning	1.80	1.33	0	1	25	38	28	4	1	1	1	0	1	100
Twisting	1.22	1.74	5	30	24	14	9	5	4	5	0	1	3	100
Weaving (broadcloth)	1.55	1.31	1	4	43	27	10	3	2	3	4	0	3	100
Weaving (tape)	2.40	1.64	0	3	11	24	14	12	7	13	7	3	6	100

The significance of dust concentrations and physical characteristics of these air contaminants will be referred to in the course of subsequent discussion.

The workers who were found particularly liable to develop severe forms of asbestosis were the willowers, pickers, carders, mule and ring spinners, twisters, and cloth weavers. Their exposure was found to be as follows:

	Dust concentration MPPCF
Willowers	11.1–36.0
Pickermen	34.3–74.3
Carders and tenders	29.1
Mule spinners	2.6– 7.9
Ring spinners	3.2– 8.3
Twisters	3.2–13.2
Cloth weavers	
Dry	4.7–49.7
Wet	4.7–11.1

MEDICAL FINDINGS

Medical examinations were made of 541 men and women representing practically all the employees at the time of study. Five-sixths of them were native born Americans of Anglo-Saxon stock and the remainder were Negro males. The three factories studied had been in operation from 6 to 16 years. About 15 months before the study, approximately 150 workers were replaced by new ones with little or no asbestos experience. As a consequence, there was an abnormally large percentage of workers with less than 5 years' employment in the asbestos textile industry and an abnormally small percentage who had worked 10 years or more in the industry. More than 200 had worked at comparable occupations in cotton or woolen textile plants, but exposures to pneumoconiosis producing dusts were inconsequential.

Characteristics of asbestosis—Pulmonary asbestosis was the principal physical defect found on examining the 541 persons. This disease, a form of pneumoconiosis caused by long continued inhalation of asbestos dust, is characterized pathologically by diffuse interstitial pulmonary fibrosis and the presence of asbestosis bodies in the lungs. Clinically, the chief symptoms are progressive dyspnea, variable cough, substernal chest pain, blood streaked sputum, decreased chest expansion, emaciation, weakness, clubbed fingers, or curved nails. Late in the disease, the dyspnea becomes distressing, cyanosis may occur, and there may be severe paroxyms of coughing productive of tenacious sputum. The characteristic chest X-ray shows granular or ground glass markings with more or less obliteration of usual linear pulmonic markings, localized in mid-lung and bases. The grainy appearance may become quite generalized with evidence of emphysema usually in the apices. Nodular or nodulo-conglomerate shadows of silicosis are not observed, but whether this is due to a peculiarity of asbestos dust or to rare occurrence of extremely high dust exposures, it is impossible to say. Shagginess of the heart shadow is not infrequently observed and seems to be most common in workers exposed to a high proportion of fiber (e.g., twisting, broadcloth weaving). By fluoroscopy, diminished excursion of diaphragm is seen. Peaking deformities of diaphragm, however, occur less frequently than in silicosis.

Asbestosis bodies found in the lungs and sputum are characteristic. There is good evidence that these bodies originate as a cellular response to inhaled fibers.[9] Asbestosis bodies consist of a core of asbestos fiber surrounded by iron-containing protein deposits. They are golden yellow in color, and do not stain with ordinary histologic stains but become brilliant blue when treated with potassium ferrocyanide. They are variable in form and size and characteristically are slender, elongated, segmented structures with bulbous ends which give them a dumbbell or drum-

FIGURE II—Photomicrographs of Asbestosis Bodies Found in Sputum. Enlarged 530 Times (Except E, Which Is Enlarged 310 Times). A Scale, Ruled in Units of 50 Microns, Has Been Drawn Beside Each Asbestosis Body.

stick shape (Figure II). Occasionally a forked or Y-shaped body is observed. They range from 10 to 180 μ in length, averaging about 35 μ.

It has been suggested that damage to the lungs occurs while the body is being formed, but once the body is formed the fiber in the core is rendered inert by its coating of iron.[10] The finding in the sputum of clumped asbestosis bodies in radial pattern or rosette (Figure II E), which is common in lung sections, has been suggested by Stewart, Tattersall, and Haddow[11] as a clear indication of disintegration of lung tissue whether by a process of simple suppurative broncho-pneumonia, or as a result of secondary tuberculous infection. In either case, they feel that it strongly indicates a definite underlying asbestosis.

On single sputum specimen analysis

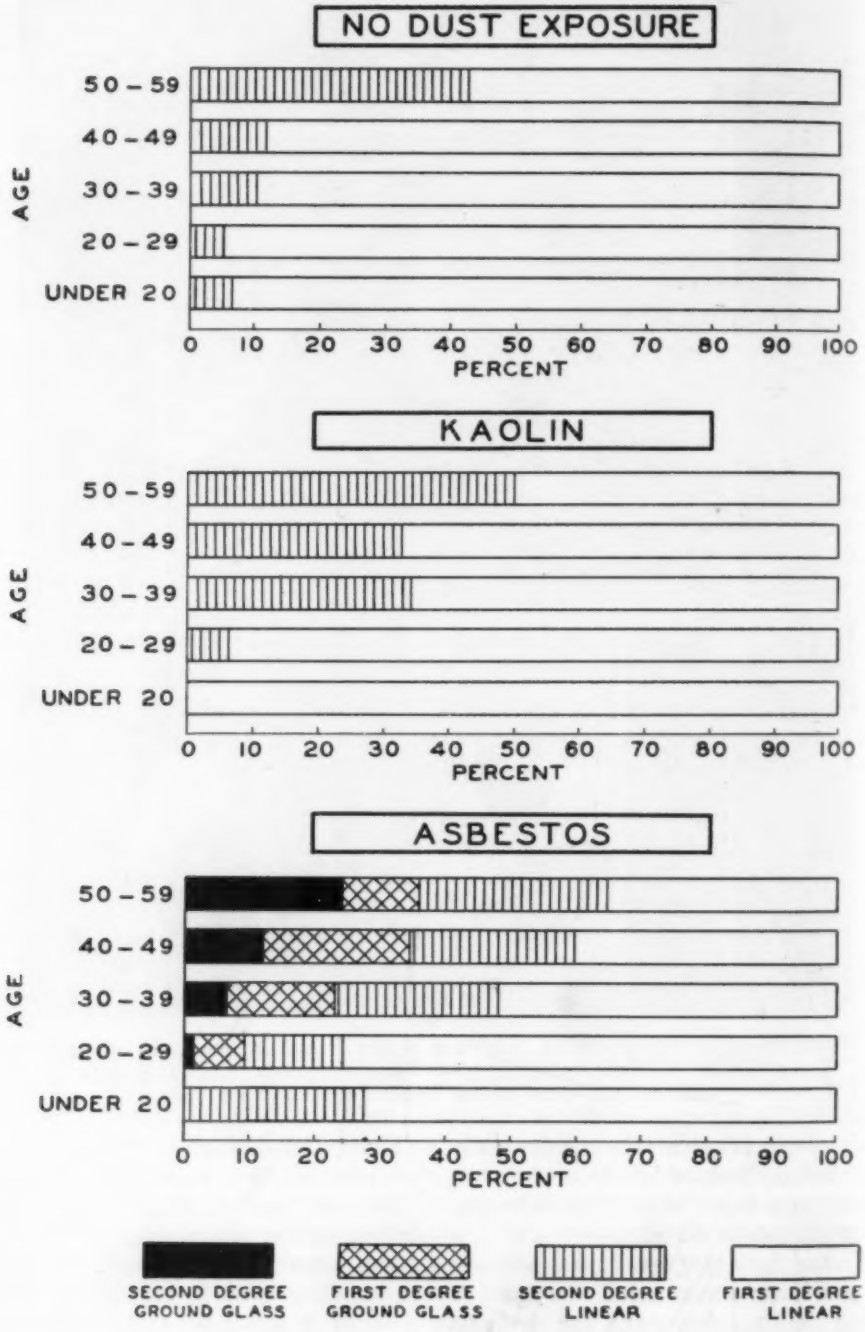


FIGURE III—Percentage of Males, Classified by Age, Who Had Certain Lung-Field Markings; 229 Men Had No Previous Industrial Dust Exposure, 80 Had Been Exposed to Kaolin Dust, and 357 Had Been Exposed to Asbestos Dust.

of each case, the incidence of asbestosis bodies increased with increasing dust exposure. They were found in sputum of 46.9 per cent persons whose condition was diagnosed as asbestosis, whereas 24.3 per cent of essentially normal asbestos-exposed persons had bodies in the sputum. They were not observed in any of the persons surveyed with less than 3 months' exposure. Since they may be found in the sputum before significant fibrotic changes have occurred, their presence is interpreted as merely showing evidence of exposure.

X-ray interpretations—During the development of a typical pneumoconiosis, the lung field appearances of chest roentgenograms pass through a series of rather well defined phases. Beginning with the normal adult film with its linear pulmonic markings, the first next appreciable change is an exaggeration of these markings. Then a ground glass or granular appearance is noted which gradually obliterates the linear markings, followed by nodular and nodulo-conglomerate markings. The lung field appearances in asbestosis do not appear to proceed beyond the ground glass or granular phase. Classification of all films was made according to phases. The apparent small amount of involvement of lungs makes it difficult to evaluate the severity of the case from an X-ray film only. The difficulties of interpretation of the chest films emphasize the importance of careful technic. As a form of pneumoconiosis, asbestosis strikingly indicates the necessity for clinical study of a case before diagnosis can be made. The film of a patient severely ill with asbestosis may have markings which would appear insignificant alongside a typical silicotic film of a man who is actively at work.

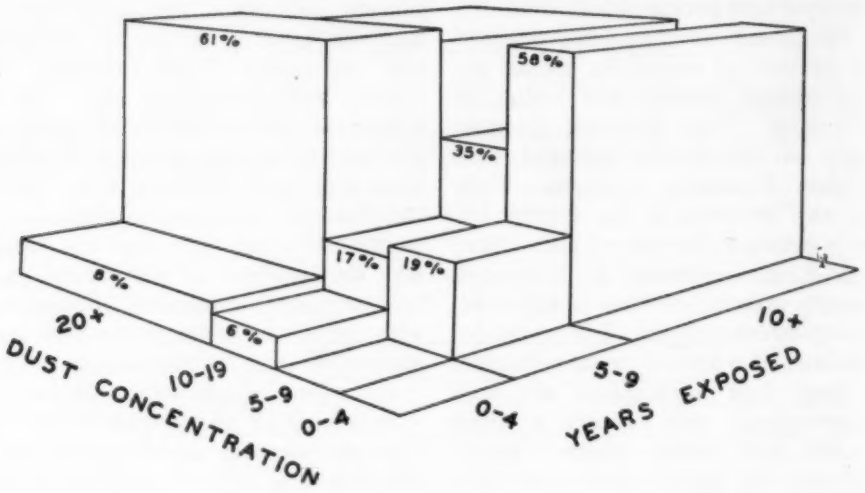
In the interpretation of asbestotic films the physician must be aware of exaggerated markings attributable to advancing age. This is illustrated in Figure III. One group comprising 229 men had never been employed in a dusty trade; the other included 80 men engaged in mining and refining of kaolin by wet methods. The percentage of men who have second degree exaggeration of linear lung markings increases with advancing age. It is significant that in this entire group of 309 men there were no cases of ground glass lung field markings, even though this change is observed in the asbestos workers. It appears that the reason why the incidence of the ground glass type of pulmonic marking is correlated with age is that older people have been exposed to dust for the longest time.

Occurrence of asbestotic lung changes—In Figure IV the heights of vertical bars represent the percentages of asbestos workers in different exposure groups who had ground glass lung field markings of either first or second degree. Seventy-six controls have been excluded from this tabulation and a number of workers whose dust exposure was not known have also been omitted.

Considering the four dust exposure groups, one at a time, there is a consistent and regular increase in the percentage of persons with these ground glass markings with increasing length of employment. Age, of course, also increases with length of employment, but these fibrotic changes cannot be ascribed to advancing age because the previous figure (III) showed that fibrotic changes of this degree are not to be expected in workmen of comparable age who are not exposed to siliceous dusts. Note the absence of cases with ground glass markings in the group exposed to less than 5 m.p.p.c.f.

Obviously, there are great differences between individuals in the time that elapses from their first exposure to asbestos dust and the time fibrotic evidence is observed in the X-ray film. In some persons this was much less than 5 years and in others it appears to be more than 10. Some of the difference

FIGURE IV—Percentage of Asbestos Textile Workers, Classified by Average Dust Concentration (Measured in Million Particles per cu. ft.) and Duration of Exposure, Found to Have Ground-Glass Lung-Field Markings.



is probably due to total amount of asbestos dust inhaled. Difference in amount of physical exertion may play an important rôle—a person in a sedentary job having a smaller need for oxygen inhales less air and consequently fewer particles of asbestos.

It was noted that the relation between dust exposure and the incidence of ground glass lung field markings was not a simple one. Even when length of employment was disregarded, it was found that incidence of these markings was proportionately lower at 10 to 19.9 m.p.p.c.f. than it was at the next higher or next lower concentrations. Although it is probable that these differences represented sampling errors due to small numbers of exposed persons, it may be that asbestos fiber excites a different and possibly more severe reaction than asbestos particles.

On account of large labor turnover, as well as the short time that the plants had been in operation, no exact estimate of incidence of asbestosis can

TABLE IV

Occurrence of Asbestosis in Relation to Dust Concentration and Length of Employment Percentage With Asbestosis

Dust Exposure, Million Particles per Cubic Foot		*Years in Asbestos Industry*		
		0 to 4.9	*5 to 9.9*	*Over 10*
0 to 4.9	Affected	2	1	0
	Exposed	84	19	5
	Percentage	*2%*	*5%*	*0%*
5 to 9.9	Affected	0	6	13
	Exposed	70	37	19
	Percentage	*0%*	*16%*	*68%*
Over 10	Affected	8	22	21
	Exposed	134	43	36
	Percentage	*6%*	*51%*	*58%*

be made. Table IV shows, however, that the percentage of persons with asbestosis increases greatly with increasing length of employment. Lanza, McConnell, and Fehnel [12] reported a similar trend. The incidence also increases with increasing dust concentration. For the reason that there are but few cases with more than 15 years' exposure, the percentages in Table IV are necessarily minimal estimates of prevalence of asbestosis even though several of the former employees are included.

SAFE LIMITS OF EXPOSURE TO ASBESTOS DUST

For practical purposes it is useful to have a definition of safe working conditions. Ideally, a threshold concentration of dust should be the highest dust concentration that would not produce pneumoconiosis in originally healthy workmen during their entire working life. Below 2.5 m.p.p.c.f. the interpretation of Table IV offered no difficulties, since none of 39 persons exposed to that concentration had asbestosis, although only 6 had been employed more than 5 years. Three doubtful cases of asbestosis fell in range 2.5 to 4.9 m.p.p.c.f.

Because clean-cut cases of asbestosis were found in dust concentrations exceeding 5 m.p.p.c.f., and because they were not found at lower concentrations, 5 m.p.p.c.f. may be regarded tentatively as the threshold value for asbestos-dust exposure.

TABLE V

Percentages of Workers Exposed to Certain Concentrations of Asbestos Dust in Asbestos Textile Factories Where Dust Control Measures Are Used to a Limited Extent and in Factories Where Effective Dust Control Is Practised

Dust Concentration Million Particles per Cubic Foot	*Limited Use of Dust-Control Measures* *	*Extensive Use of Dust-Control Measures* †
Over 10	48	7
5 to 9.9	28	17
2.5 to 4.9	15	32
Under 2.5	9	44

* Data from Table IV.
† Data from reference 13.

A supplemental engineering study [13] was made in an asbestos textile factory in which dust control equipment had recently been installed. This showed that means are already available for reducing the dust exposure of a majority of asbestos textile workers to less than 5 m.p.p.c.f. The basis of this control was exhaust ventilation near source of dust.

CONCLUSIONS

As in other forms of pneumoconiosis, occupational history, and clinical and X-ray (or pathologic) findings must be in harmony before a sound diagnosis can be made. The occupational history should be a reflection of manufacturing processes since the job designation refers to a stage in manufacture. The occupations which were found particularly liable to induce severe forms of asbestosis were willow, pick, card, spin, twist, and cloth weave. Confirmation of the hazardous nature of some of these occupations is the frequency with which the occupational designation of carder, weaver, or spinner is encountered in autopsy reports of cases.[14–18] The following are the outstanding findings determined in this study:

1. In a study of 541 employees of North Carolina textile mills, pulmonary asbestosis was the principal physical defect found.
2. The most serious forms of the disease were observed in carders, spinners, weavers, twisters, willowers, and pickers.
3. Exposures ranged from 0.10 to 76 m.p.p.c.f.
4. Dust contaminants of air in asbestos textile plants are both particulate and fibrous.
5. It is imperative that findings of occupational history, clinical examination, and X-ray film all be considered in making diagnosis of a case.
6. Definite clinical and roentgenographic

evidence of asbestosis is observed in exposed persons after 5 to 10 years of work in exposures exceeding 5 m.p.p.c.f.

7. It appears that if asbestos dust concentrations in the air breathed are kept below 5 m.p.p.c.f. new cases of asbestosis will not appear.

8. Methods for controlling the dust below this tentative threshold are already available for most of the processes in the industry.

REFERENCES

1. Gloyne, S. R., and Merewether, E. R. A. *Asbestos. Occupation and Health* (Suppl.), International Labour Office, Geneva. 1938.

2. Cooke, W. E. Pulmonary Asbestosis. *Brit. M. J.*, 2:1024–1025, 1927.

3. McDonald, Stuart. Histology of Pulmonary Asbestosis. *Brit. M. J.*, 2:1025–1026, 1927.

4. Hoffman, F. L. Mortality from Respiratory Diseases in Dusty Trades (Inorganic Dusts). *Bull. U. S. Bur. Lab. Stat. No. 231*, 1918, pp. 176–180.

5. Pancoast, H. K., Miller, T. G., and Landis, H. R. M. A Roentgenologic Study of the Effects of Dust Inhalation Upon the Lungs. *Tr. A. Am. Physicians*, 32:97–108, 1917.

6. Mills, R. G. Pulmonary Asbestosis: Report of a Case. *Minnesota Med.*, 13:495–499, 1930.

7. Lynch, K. M., and Smith, W. A. Asbestosis Bodies in Sputum and Lung. *J.A.M.A.*, 95:659–661, 1930.

8. A Study of Asbestosis in the Asbestos Textile Industry. *Pub. Health Bull. No. 241*, Aug., 1938.

9. Gloyne, S. R. The Asbestosis Body. *Lancet*, 1:1351–1356 (June 25), 1932; Sundius, N., and Bygden, A. Der Staubinhalt einer Asbestosislunge und die Beschaffenheit der sogenannten Asbestosiskorperchen. *Archiv. f. Gewerbepath. u. Gewerbehyg.*, 8:26–70, 1937; Gloyne, S. R. The Morbid Anatomy and Histology of Asbestosis. *Tubercle*, 14:445–451; 493–497; 550–558, 1933.

10. Kettle, E. H. The Interstitial Reactions Caused by Various Dusts and Their Influence on Tuberculous Infections. *J. Path. & Bact.*, 35:395–405, 1932.

11. Stewart, M. J., Tattersall, N., and Haddow, A. C. On the Occurrence of Clumps of Asbestosis Bodies in the Sputum of Asbestos Workers. *J. Path. & Bact.*, 35:737–741, 1932.

12. Lanza, A. J., McConnell, W. J., and Fehnel, J. W. Effects of the Inhalation of Asbestos Dust on the Lungs of Asbestos Workers. *Pub. Health Rep.*, 50:1–12, 1935. *Reprint No. 1665.*

13. Page, R. T., and Bloomfield, J. J. A Study of Dust Control Methods in an Asbestos Fabricating Plant. *Pub. Health Rep.*, 52 (Nov. 26), 1937. *Reprint No. 1883.*

14. Lynch, K. M., and Smith, W. A. Pulmonary Asbestosis II. *Am. Rev. Tuberc.*, 23:643–660, 1931.

15. Egbert, D. S. Pulmonary Asbestosis. *Am. Rev. Tuberc.*, 31:25–34, 1935.

16. Stock, G. A. Pulmonary Asbestosis. *M. Bull. Vet. Admin.*, 10:126–129, 1933.

17. White, T. P. Pulmonary Asbestosis. *Tr. Med. Soc. North Carolina*, 1935, pp. 259–262.

18. Lynch, K. M., and Smith, W. A. Carcinoma of Lung in Asbesto-silicosis. *Am. J. Cancer*, 24: 56–64, 1935.

Factors Influencing Nonspecific Resistance to Infection*

CHARLES F. CHURCH, M.D., F.A.P.H.A. †

Director, Rockefeller Nutrition Fund, Children's Hospital of Philadelphia, Philadelphia, Pa.

THE study of experimental infections in pure lines of mice has made possible the separate evaluation of host factors and parasite factors influencing the course and outcome of acute infectious disease.[1] When the parasite factors, including strain, virulence, dosage, and portal of entry, are maintained constant, the survival of the host following inoculation is conditioned by heredity, nutrition, and by environmental factors directly affecting the host.

In a previous report the resistance of young mice to mouse typhoid was shown to be greatly influenced by the diet of the mothers during pregnancy and lactation.[2] The environmental factors were maintained uniform by isolation of the inoculated mice in individual cages in an air-conditioned room. The purpose of this paper is to review the effects of heredity and of nutrition upon resistance to infection and to present a method for the evaluation of natural resistance independent of the development of specific immunity.

The results here presented are derived from the study of 2,868 mice inoculated by stomach tube, at the age of 8–9 weeks, with a standard dose of *Salmonella enteritidis*. The technic employed has been described in a previous publication.[2]

The virulence of the test organism for this particular host has remained unchanged through these experiments. When the genetic background, the dietary background, and the external environment of the host were kept constant, the survival curves for groups of 20 mice were reproducible within the limits of statistical variation (Figure I). The first deaths occurred about the 6th day after inoculation and the point of 50 per cent mortality was reached on the 8th to 9th day. The mean survival at the end of 28 days was from 0 to 15 per cent. The uniformity of these results with groups of mice of the same genetic and dietary background indicates the constancy of host and parasite factors in these experiments. There is no evidence of seasonal variation in the periods covered (October to May and September to March).

The course of the experimental infection in the organs and tissues has been followed by bacteriological studies* of mice killed on successive days following intrastomachal inocu-

* Read before the Epidemiology Section of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 26, 1938.

† Since September, 1938, at the School of Hygiene and Public Health, University of Michigan, Ann Arbor, Mich.

* These studies were suggested by the work of Madsen (Flexner Lectures, Series No. 5, 1937).

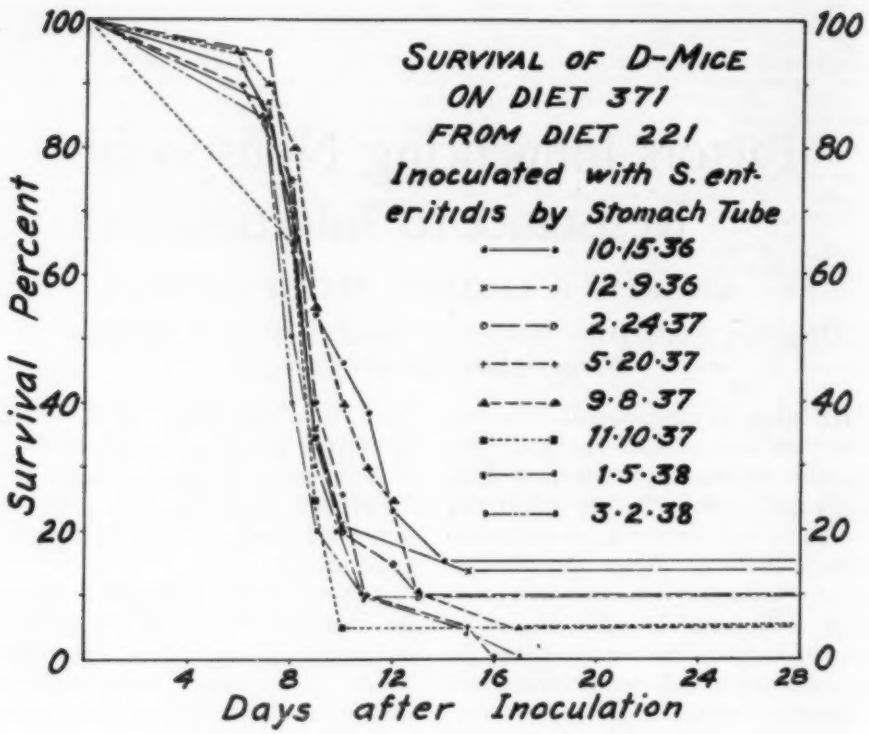


FIGURE I—Successive virulence tests on *Salmonella enteritidis*

lation. The organism was found in the mesenteric lymph nodes 2 days after inoculation and reached the blood stream on the 3rd day. It successively invaded the spleen, axillary and submaxillary lymph nodes, liver, and kid-

TABLE I

Effect of Selective Breeding and Selective Nutrition on Natural Resistance to Infection

Type of Experiment	*Line of Mice*	*Maternal Diet*	*Contemporaneous Diet*	*No. of Mice Inoculated*	*Survival*		*Mean Survival Time in Days*[1]
					No.	*Per cent*	
Standard Control (Figs. II, III, VI)	D	200	371	100	33	33.0	11.2±0.33
Selective Breeding (Figs. II & III)	A	200	212	100	91	91.0	22.0±0.78
	B	200	212	67	1	1.5	7.2±0.18
Selective Nutrition:							
(a) Contemporaneous Diet (Fig. IV)	A	200	212	42	37	88.1	22.2±1.11
	A	200	241, 245	27	11	40.8	12.8±1.21
(b) Maternal Diet (Fig. VI)	D	200b[2]	371	66	52	78.8	16.1±0.60
	D	221	371	100	7	7.0	9.1±0.16

1. The Mean Survival Time with its standard deviation was derived by the graphic method illustrated in Figure III. It is independent of the development of immunity.
2. Diet 200b is Diet 200 continued as a breeding diet through four generations.

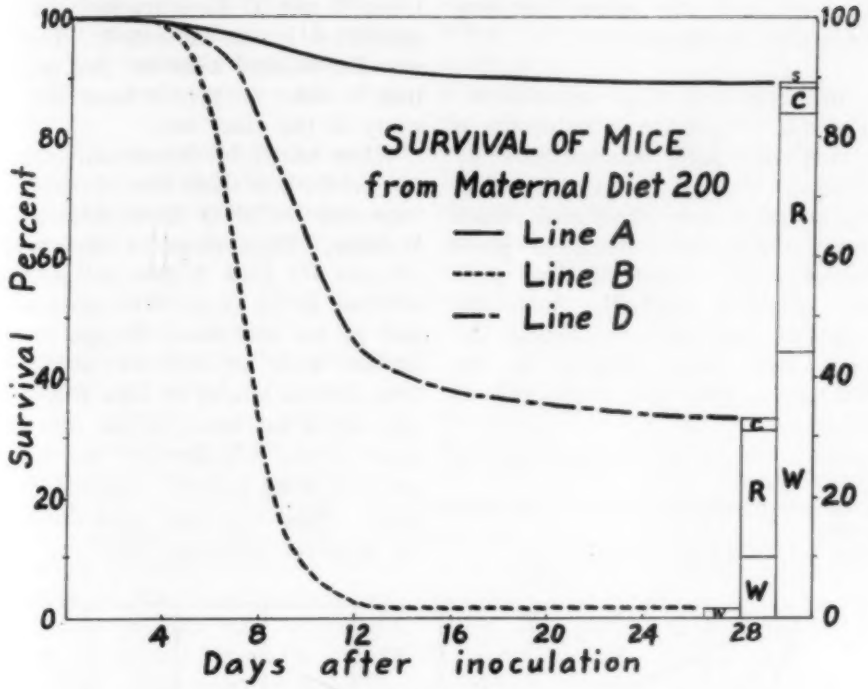


FIGURE II—The influence of heredity upon resistance to infection

neys. The organism tended to disappear from the alimentary tract of those that survived 10 days or more, although reinfection of the intestine occurred by way of the bile. The mesenteric nodes remained solidly infected to the 30th day. The organism was recovered from the spleens of 61 per cent of the survivors necropsied 31 to 60 days after inoculation, and of 29 per cent of those examined 61 to 90 days after inoculation. Included in these survivors are those from groups of high resistance, many of which had shown no symptoms of infection, but which, nevertheless, continued to carry

TABLE II

Composition of Diets per 100 Calories
By Chemical Analysis of the Ingredients

	Calories			*Milligrams*					
Diet	*Pro.*	*Carb.*	*Fat*	*Ca*	*Mg*	*K*	*Na*	*P*	*Cl*
Natural Foodstuffs									
200	16	68	16	118	19	152	62	90	98
221	16	59	25	105	13	199	136	139	232
Purified Food Elements:									
212	19	72	9	149	18	270	43	145	52
241	19	72	9	28	18	266	43	143	52
245	16	75	9	29	23	302	61	149	79
371	25	70	5	160	24	195	115	155	177

the organism in the spleen for long periods after inoculation.

A. HEREDITY AND HOST RESISTANCE

The rôle of heredity in resistance to infection has been demonstrated by Webster.[3, 4] By selective breeding, lines of mice were developed which respond characteristically to a given infective agent. Three of these pure lines, obtained originally from the Rockefeller Institute for Medical Research, have been studied in our laboratory. They are designated as follows:

Line A — Rockefeller Institute Resistant (BRVS)
Line B — Rockefeller Institute Susceptible (BSVR)
Line D — Swiss Mice (Unselected)

Lines A and D have reached the 8th generation in our laboratory. Line B was discontinued after the 3rd generation in order to permit more detailed study of the other two.

When tested by inoculation with *S. enteritidis* these three lines of mice gave responses similar to those obtained by Webster. In a series of experiments (Figure II) Line A gave 89 per cent survival at 28 days after inoculation, and 44 per cent came through the infection with no evidence of illness. The contrast offered by Line B is striking, for of the latter 50 per cent were dead by the 8th day and less than 2 per cent (one animal) survived to 28 days. These two lines were developed by selective breeding from the same

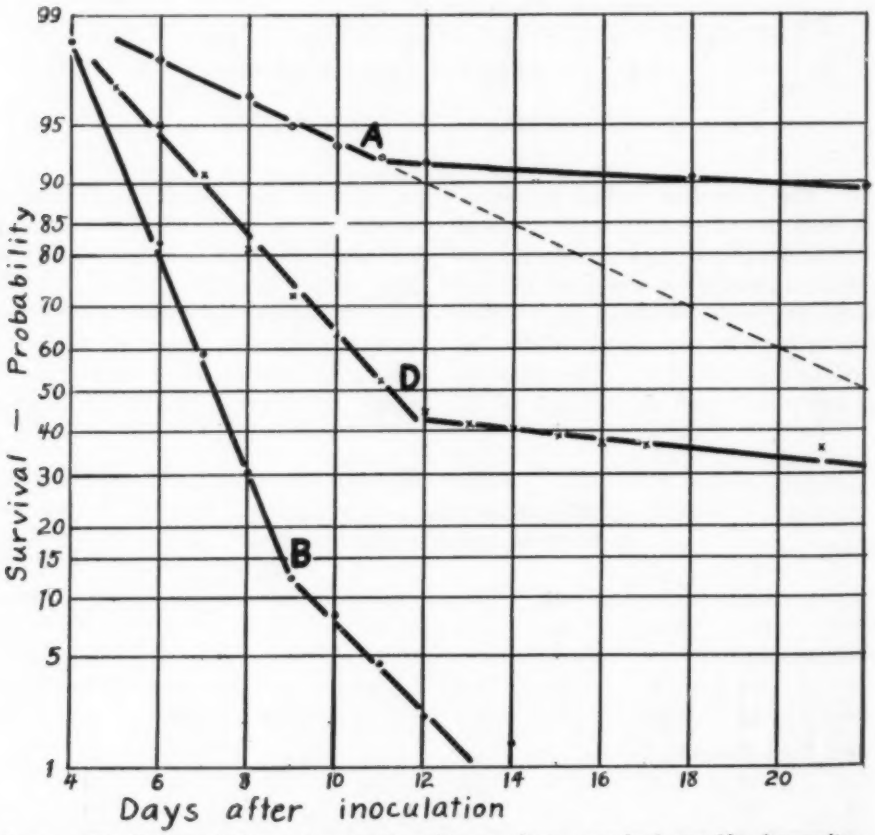


FIGURE III—Differentiation of natural resistance from acquired specific immunity. The survival data shown in Figure II is plotted on arithmetic-probability coördinates

original stock and therefore demonstrate the marked degree to which heredity may influence host resistance when all other factors are kept constant.

Line D is a genetically unselected line and shows, as may be expected, a survival rate intermediate between the Resistant and the Susceptible lines: namely, 33 per cent.

The sigmoid shape of these curves suggests that they may be curves of normal frequency distribution of deaths with respect to time.[5] This can be tested by plotting the results on arithmetic probability paper (per cent survival against time after inoculation). A straight line relationship will then indicate a normal frequency distribution. When the survival curves for the three lines of mice are plotted thus, there results in each case a straight line bent or deflected near the middle (Figure III). The point of deflection is from 9 to 12 days after inoculation and corresponds in time to the rise of the antibody titer in the blood serum of the infected animals.

The first part of the curve is obviously that determined by the natural resistance of the previously unexposed population, whereas the deflection of the lower limb indicates a change (increase) in the resistance of those that have survived the first onslaught of the infection. This increase in resistance, 9 to 12 days after inoculation, may be due to the rise of specific immunity.*

Since the upper limb of the curve is that determined by the nonspecific resistance of the group we have only to follow this line to its intersection with the abscissa for 50 per cent survival to obtain the mean survival time uninfluenced by specific immunity. When the upper limb does not extend to the 50 per cent abscissa, as with the Line A curve, it may be extrapolated to the point of intersection.

The mean survival time obtained in this way is a measure of nonspecific resistance which can be applied to any homogeneous population tested with a suitable pathogen under controlled conditions.

B. DIET AND HOST RESISTANCE

1. The contemporaneous diet—Host resistance is not readily influenced by the diet during or immediately preceding the period of infection. Changing the diet within rather wide limits from the normal, 2 weeks before inoculation, had little effect upon survival. This was indicated in Webster's work[7] and is borne out by the recent results of Topley[8] and Watson.[9]

Certain changes in the contemporaneous diet, however, have a marked effect upon nonspecific resistance. The level of mineral salts in the diet is a factor of considerable importance.[10] When the level of inorganic elements was reduced to one-fourth the normal, 2 weeks before inoculation, the fatality rate in Line A mice was increased from 9 to 34 per cent.[2] Drastic reduction in dietary calcium likewise resulted in increased mortality. When the calcium content of the diet was reduced from 0.55 per cent to 0.10 per cent the fatality rate increased from 12 to 59 per 100 animals (Figure IV). Uninoculated control groups maintained upon each of these low mineral diets suffered no fatality over a 10 week period.

It is possible, therefore, to influence host resistance by making the contemporaneous diet insufficient or unbalanced with respect to mineral salts. Our attempts to produce similar depression of resistance in Line A mice by deprivation of vitamin A, of vitamin

* The agglutinin titer in the sera of survivors after 28 days was 1:80 or greater, while the sera of mice killed 8 days after inoculation gave no agglutination in 1:20 dilution.

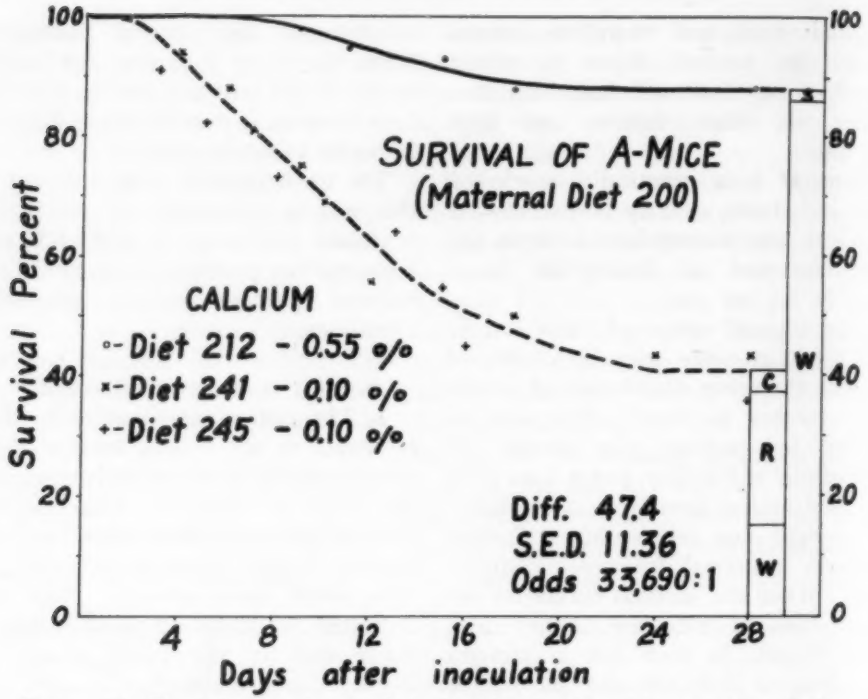


FIGURE IV—The influence of a marked alteration in the calcium content of the contemporaneous diet upon resistance to infection

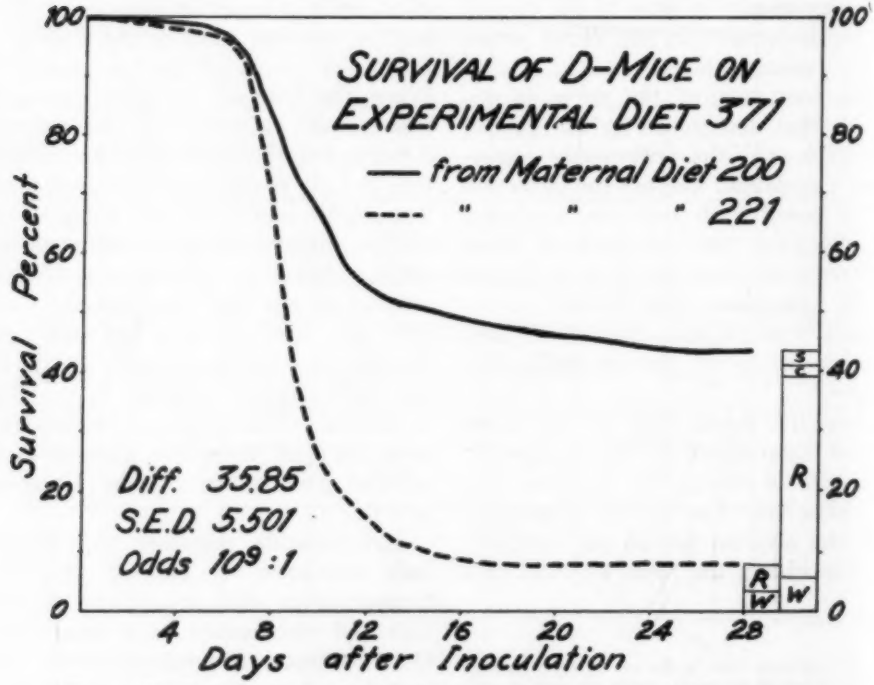


FIGURE V—The effect of the diet during pregnancy and lactation upon the resistance of the offspring

D, and of fat have failed.[11] This, together with the evidence of the importance of the maternal diet, suggests that modification of resistance is not readily effected through the contemporaneous diet.

2. *The maternal diet*—The diet of the mother during pregnancy is a factor of major importance in determining the resistance of the offspring to mouse typhoid infection.[12] In our experiments comparisons were made between a simple diet of three ingredients (Diet 221) and a mixture of ten ingredients (Diet 200). These two diets were almost equally satisfactory for the breeding and rearing of Line D mice. When the progenies from these two maternal diets were placed upon the same diet and tested by inoculation with *S. enteritidis* the survival of those born of mothers on the diet of ten ingredients was significantly greater than the survival of those born of mothers on the diet of three ingredients. Of those born on Diet 200, 47.1 per cent survived the infection, while of those born on Diet 221 only 11.8 per cent survived. The statistical significance is indicated by the odds of 3,671 to 1.

In subsequent experiments the progenies from these two maternal diets were changed to the same purified diet during the contemporaneous period in order to rule out any effect of gastrointestinal contents upon the initial growth of the organism. The results were similar (Figure V). Survival in the progenies born on Diet 200 was 43.4 per cent, while in those born on Diet 221 it was 7.8 per cent. Because of the large number of animals used the statistical significance is very high.

Both of these diets were adequate for normal growth and reproduction and, by the usual criteria of growth rate, size of litter, fertility, and weight of young at 10 and 25 days, were almost equally satisfactory. Chemical analysis[13] revealed a number of differences in composition but gave little clue to the essential factors.[2] But the progenies from mothers changed at mating to the diet of three ingredients (Diet 221) showed low resistance, whereas those from mothers placed at mating on the diet of 10 ingredients (Diet 200) showed high resistance to the test infection. The improvement in resistance was greater when the change to diet 200 was made 8 weeks or more before mating. Successive generations on the resistance-inducing diet showed progressive increase in survival percentage. The greatest increase in resistance (survival of 79 per cent as compared with 7 per cent) was obtained after three generations on the resistance-inducing diet (Figure VI).

These differences in the host resistance of young mice from the two maternal diets appear to be the result of differences in the nutrition of the mothers. The possibility of variations in the genetic constitution of Line D mice as a result of heterozygous matings cannot as yet be ruled out absolutely, since strict sibling mating has been practised for only 8 generations. However, in view of the consistency of the survival responses of progenies from the two maternal diets this possibility appears remote.

Watson[9] has recently reported resistance tests on mice maintained on 8 different diets. The young were subjected to the test diet either from the prenatal period onward or for only 3 weeks before being tested. At 12 weeks of age they were inoculated with mouse typhoid (100 million organisms by mouth) and were placed in individual cages. The hereditary factor was not controlled, the stock mice having been obtained from several different breeders. In spite of the differences in technic the results appear to be essentially in agreement with those given here. Three weeks on the test diet

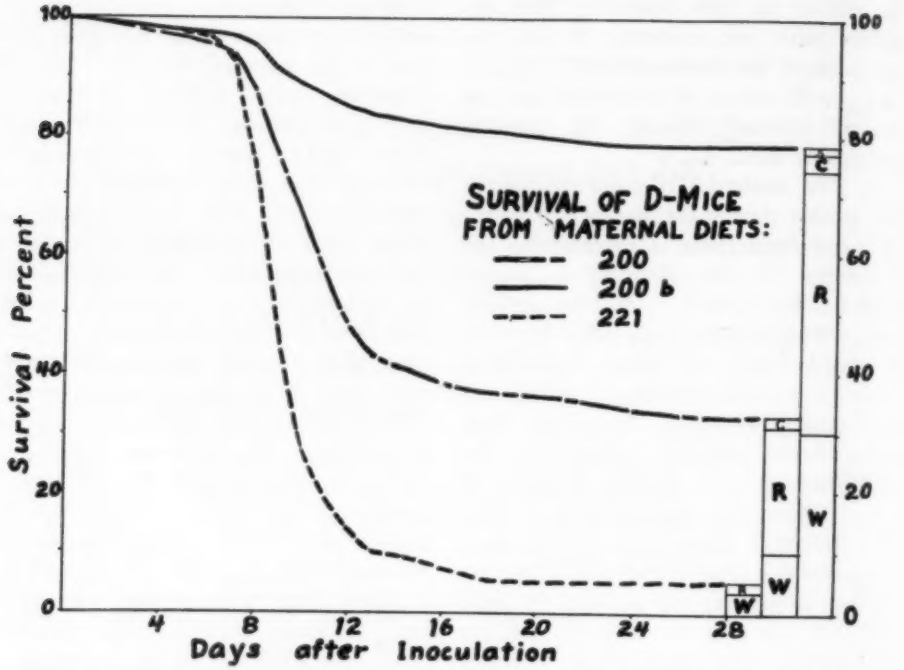


FIGURE VI—The influence of the maternal diet, continued for four generations, upon the resistance of the offspring

before inoculation had no apparent effect upon resistance, whereas exposure to the influence of certain diets from the prenatal period onward gave rise to significant changes in resistance.

SUMMARY

Nonspecific resistance to infection has been studied in 2,868 mice of three lines, inoculated with *Salmonella enteritidis*. When the external environment and the parasite factors including strain, virulence, dosage, and portal of entry, were kept uniform, the survival of mice at risk was dependent upon heredity and nutrition.

When the dietary background was kept uniform the three lines of mice gave mortality responses in agreement with those obtained by Webster. The time-survival data of each line gave a normal frequency distribution truncated at 9 to 12 days after inoculation. The point of truncation appears to coincide with the antibody response of those that survive the first onslaught of infection.

By graphic analysis the mean survival time of the original population, independent of the effect of specific immunity, can be derived. It is suggested that the mean survival time obtained in this way is a measure of nonspecific resistance which can be applied to any homogeneous population tested with a suitable pathogen under controlled conditions.

The diet of the mother before and during gestation was a factor of major importance in influencing the resistance of the offspring to the risk of infection. The protection thus afforded lasted at least until maturity was reached, and progressive improvement took place for at least three generations on the same diet. The influence of diet upon resistance may thus be on a par with the influence of heredity.

Explanation of Charts: Each curve represents a group of mice (usually 20 or multiples of 20) of the same genetic and dietary background, inoculated by stomach tube with a standard dose of *Salmonella enteritidis* and kept under observation for 28 days. Survival *per cent* is plotted against time in days.

The clinical condition of the surviving group is shown by the vertical columns at the right: W = Well through entire period; R = Ruffed fur only; S = Sick; C = Convalescent.

The statistical analysis in Figures IV and V is indicated as follows: Diff. = Difference between survival percentages at 28 days; S.E.D. = Standard Error of the Difference =

$$100\sqrt{PQ\left(\frac{1}{n}+\frac{1}{n'}\right)};$$

Odds against the observed difference being the result of chance.

NOTE: I acknowledge my gratitude to Dr. L. T. Webster, Dr. J. C. Gittings, Dr. Joseph Stokes, Jr., and the Rockefeller Foundation for the opportunity of conducting this study; My appreciation to Miss Claire Foster and Miss Dorothy W. Asher for assistance in carrying it on. C. F. C.

REFERENCES

1. Webster, L. T. Experimental Epidemiology. *Medicine*, 11:321, 1932.

2. Church, C. F., Foster, Claire, and Asher, Dorothy W. Diet and Resistance to Infection. The Effect of the Maternal Diet. *A.J.P.H.*, 27:1232, 1937.

3. Webster, L. T. Development of Resistant and Susceptible Lines of Mice Through Selective Breeding. *J. Exper. Med.*, 57:793, 1933.

4. Webster, L. T. Inheritance of Resistance of Mice to Enteric Bacterial and Neurotropic Virus Infections. *J. Exper. Med.*, 65:261, 1937.

5. Bliss, C. I. *Ann. Applied Biol.*, 24:815, 1937.

6. Webster, L. T., and Pritchett, Ida W. The Effect of Diet on Host Resistance. *J. Exper. Med.*, 40:397, 1924.

7. Pritchett, Ida W. The Effect of Diet on Host Resistance (Further Studies). *J. Exper. Med.*, 46: 557, 1927.

8. Topley, W. W. C., Greenwood, M., and Wilson, J. The Effect of Diet in Epidemic Infection in Mice. *J. Path. & Bact.*, 34:163, 1931.

9. Watson, Marion. The Effect of Various Diets on the Resistance of Mice to Bacterial Infection. *J. Hyg.*, 37:420, 1937.

10. Church, C. F. The Effect of Dietary Minerals on Host Resistance. *J. Bact.*, 34:350, 1937.

11. Church, C. F. Unpublished data.

12. Church, C. F., and Foster, Claire. Effect of Diet Upon Resistance to Infection. I. Maternal Diet. *Am. J. Dis. Child.*, 54:1178, 1937.

13. Asher, Dorothy W. Mineral Metabolism. *Am. J. M. Technol.*, 4, 1938.

A Hopeful View

PULMONARY tuberculosis is a chronic systemic disease with a decided tendency to heal. The chronicity, inherent tendency to heal, and curability are due to a beneficent auto-immunization. Were this not true the human race would long since have vanished. This chronicity, when the disease is untreated, inadequately treated, or unrecognized, is responsible for its continuous contagion and universal distribution, for a reducible economic waste and disability, and for a certain irreducible mortality rate. . . . A Program for Early Aggressive Treatment of Pulmonary Tuberculosis, Casper F. Hegner, M.D., *J.A.M.A.*, Jan. 14, 1939, p. 136.

Production of Antipneumococcic Rabbit Serum*

B. SCOTT FRITZ, V.M.D.

The Gilliland Laboratories, Marietta, Pa.

ANTIPNEUMOCOCCIC Rabbit Serum, Therapeutic, introduces the clinician to an entirely new product in the field of serum therapy. The results obtained from the use of immune rabbit serum in the treatment of pneumococcic pneumonias in the Hospital of the Rockefeller Institute for Medical Research, New York,[1] and Long Island College of Medicine,[2] indicate that the serum is an effective adjunct in the treatment of pneumococcic pneumonias. Recognition is given those from the Hospital of the Rockefeller Institute for the pioneer work that has been done with antipneumococcic rabbit serum. The report on the production, processing, and standardization of antipneumococcic rabbit serum,[3] is informative and of great value to those interested in the many phases of this work.

This report is submitted with the hope that it may prove of some interest to those producing or who may anticipate the production of type specific antipneumococcic rabbit serum. It deals with the production of serum as carried out in a commercial laboratory. The methods were developed following the counsel and literature of those mentioned. The report further deals with the rabbit mortality incident to the production of type specific sera from a colony of approximately 1,000 rabbits.

ESTABLISHING THE COLONY

It is no small undertaking to establish a sizeable colony of rabbits and maintain it in a state of health conducive to the economic production of immune sera.

After thorough consideration of the problems involved, reliable sources for rabbits were contacted with the hope of arranging a satisfactory plan for purchase. Those interviewed were willing to supply rabbits subject to approval. Conditions of sale specified that the rabbits be in an acceptable condition of health, weigh 4 lbs. or more, and be preferably of the New Zealand Red or Chinchilla breed. It was further specified that young rabbits were preferred and all stock must have a good ear with a visible marginal ear vein. They were purchased at a given price per lb. which was considered fair and acceptable for the purchaser and seller. The rabbits delivered to the laboratory were carefully examined, the history of their origin noted, in so far as disease was concerned, weighed, and segregated in a unit specially planned for the purpose. During the early period of partial isolation, and as soon as was practicable, all rabbits were injected subcutaneously with 5 c.c. of polyvalent

* Read before the Laboratory Section of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 28, 1938.

whole culture antihemorrhagic septicemia bacterin. After isolation of 10 to 14 days, the rabbits were moved into the unit designed for the producing group. During isolation they were examined daily for symptoms of infectious or contagious disease. Fortunately the source of supply was good and most of the rabbits purchased had been raised on local farms or in comparatively small colonies. Rabbits were occasionally rejected and if one or more were rejected in a particular shipment, all exposed to those individuals were likewise rejected, particularly if an infectious disease was suspected.

In view of the fact that rabbits under immunization are handled as frequently as 4 and 5 days a week, they should be housed in suitably designed buildings, and in cages conducive to a saving of time and labor. The two houses being used are 125′ long by 20′ wide with 8′, 10″ ceilings. They are well lighted by windows which provide adequate ventilation without draughts. Cupolas provide additional ventilation. Buildings are insulated to eliminate excessively high temperatures during the summer and each building is equipped with an automatically controlled oil burner fuel system which has very satisfactorily maintained an even temperature during the fall, winter, and spring. The mortality among our rabbits due to excessive heat, draughts, and similar conditions frequently responsible for many deaths in a colony not satisfactorily provided for, has been negligible. A temperature of approximately 50° F. during those months when the atmospheric temperature was considerably lower, seems ideal. The colony during the winter months has shown some evidence of snuffles. This condition was easily controlled by the addition of cod liver oil to the diet. The colony has experienced no outbreak of any disease of an infectious character.

The buildings are so designed as to provide for a row of cages on each side with a double row through the center. The cages in the center are 6 high and house 48 rabbits per section. The same number of sections are provided on each side of the buildings with the exception of beneath the windows where the cages are but 4 high. Rabbits are individually caged, the size of the cage being optional, though one 26″ wide, 20¼″ deep and 14″ high is adequate. Water is supplied each rabbit by means of an inverted glass bottle fitted with a rubber stopper through which is inserted a piece of brass tubing. The rabbit laps the water from the projecting tube. The containers are very serviceable and it has been of interest to note that most rabbits will consume 8 to 10 oz. of water a day throughout the year even when moist, green food is supplied as part of the diet.

The alleyways between cages are 4′, 10″ wide allowing ample space for the cleaners to move their carts. The individual cages have metal floors, are cleaned every other day, thoroughly washed and sprayed with a 4 per cent solution of cresol, then rebedded with clean, dry shavings. Sanitation has been maintained at all times and this factor is essential in the successful maintenance of a healthy rabbit colony.

Identification of Rabbits

Each rabbit is identified with an ear tattoo number before being assigned to the production of a specific serum. A letter or number prefix identifies the type of serum the rabbit is to produce. The rabbits are weighed and on a card attached to the cage is recorded the weight, tattoo number, and date of entry into the colony. Individual charts are kept for each rabbit, giving similar information together with a record of immunization, bleedings, and such other data as may be pertinent to the history of the animal during its life in the colony.

FEEDING

Producing rabbits, in addition to being well housed in clean, sanitary cages, should be fed a well balanced palatable diet. The rabbits purchased, coming from many sources, are undoubtedly fed a variety of diets. Animals do not do well when decided changes are made in their diets and for this reason we consulted those supplying rabbits to learn, if possbile, the foods most generally fed. This resulted in such a great variation that it was necessary to arrange for a feeding schedule that was attractive to the majority of purchased rabbits. A commercially prepared food has proved entirely satisfactory. The rabbits relish this and during the production of serum have steadily gained weight, which seems to be a reliable indication of a good food. In addition to the commercially prepared food, alfalfa, carrots, cabbage, beets, etc., of a good quality are supplied as a supplement from time to time.

BACTERIAL SUSPENSIONS FOR IMMUNIZATION CULTURES

It has been proved that virulent cultures are essential for the preparation of bacterial suspensions that will be most effective in the production of a serum of high titer in animals.[4] Type specific pneumococcus cultures are used in the smooth phase, where it is possible, and mouse virulent strains are used exclusively. The cultures being used at the laboratory are infective for mice, though some possess little or no virulence for rabbits. It is our opinion that cultures virulent for rabbits and mice are more desirable than those virulent for mice only. It has been observed that strains of pneumococcus possessing little or no virulence for mice are rarely virulent for rabbits. The cultures used for immunization should be passed each week or more frequently through either mice or rabbits, or both mice and rabbits for the maintenance of virulence. Beef heart phosphate broth to which has been added 1 per cent defibrinated blood is used as a stock broth. Cultures for animal inoculation (virulence test) are seeded from this to the same broth to which dextrose has been added, grown for varying lengths of time, approximately 4 to 8 hrs., then diluted for animal passage. The range of dilution varies in respect to the virulence of the type specific pneumococcus. All cultures are identified for specificity as well as cultural characteristics before being inoculated into broth for antigen production. The virulent strains have retained their smooth phase and virulence for many months for mice and rabbits. All strains are not rabbit virulent.

Broth

Each lot of beef heart phosphate broth is tested for its suitability and natural muscle sugar content. It is important to establish the broth as a suitable medium and this is done by tubing 20 c.c. samples from each lot. A varying amount of dextrose (.02 per cent to .08 per cent by volume) is added to each of the tubes, and each tube is inoculated with the selected strain of the pneumococcus, grown 16 hrs. at 37.5° C. and pH determinations made from the broth at the end of the growth. The amount of dextrose finally added to the lot of broth is governed by the tube which shows the optimal pH. A pH between 6.6 and 6.8 is considered optimal (within the desirable range) and the dextrose broth tube giving that titration is selected as the tube containing the ideal amount of dextrose to be added to that particular lot of broth. This may be considered an unnecessary precaution but the procedure is simple and has resulted in the production of entirely satisfactory bacterial suspensions of Gram-positive staining organisms. Certain type specific pneumococci grow very rapidly and these should not be grown at 37.5° C. for the same number

of hours for the preparation of an ideal suspension for immunization.

The antigen for immunization is prepared from the first transplant recovered from the mouse, or rabbit, and is seeded in bulk containers of broth containing not more than 3 liters. The inoculation of a large volume of broth is not as satisfactory as small volumes in the production of good bacterial suspensions. After the pneumococcus is grown for the time assigned by previous determinations for each lot, the bulk container is removed from the incubator and preserved with 1 per cent formalin. The containers are kept at room temperature until the evening of the day they were preserved; then placed in the cold box until the following morning, when the organisms are collected and resuspended in a 0.1 per cent formalized salt solution. Early in the work no attempt was made to standardize the suspension. It was noted, however, by resuspending the organisms in a definite volume of formalized salt solution representing one-tenth of the original volume of broth that the resulting suspensions were of varying turbidity, though quite uniform in staining characteristics. For this reason it was advisable to standardize the suspensions by some simple and practical method. The suspensions are now standardized to the approximate turbidity of 10,000 million typhoid bacilli per c.c. Standardization of the suspension seems advisable so that a uniform suspension is used throughout the course of immunization, particularly if the doses for immunization eventually become constant. It is appreciated that the accuracy of standardization depends upon the Gram staining structure of the bacterial suspension. Therefore, if the bacterial suspensions have autolyzed standardization is of little or no value. It has further been shown [3] that most pneumococcus suspensions possess little toxicity for rabbits and that they tolerate wide variations in the number of suspended bacteria without bad effect.

Channel of Immunization

The intravenous method of immunization is used exclusively and the marginal ear vein the portal of entry. Cole and Moore demonstrated conclusively that intravenous immunization was essential for the production of immune sera of high titer.[4]

IMMUNIZATION AND BLEEDING SCHEDULES

It is natural that consideration be given to the production of an immune serum of high titer and to the plan of immunization that is conducive to the maintenance of the animal in a satisfactory state of health and over the longest period of time. The schedule of immunization carried out by Goodner, Horsfall, and Dubos,[3] known as The Four Week Complete System, has been followed in its entirety with the exception that the holding dose has been 0.2, 0.5, 1, and 1 c.c. rather than 0.2, 0.5, 1. and 2. c.c. It was found necessary to reduce the 2 c.c. dose as will be shown later in the charts on mortality, hoping to reduce the mortality following this dose. The bleeding schedule has been followed in accordance with the plan.

BLEEDING

Rabbits are bled from the heart by cardiac puncture. The precardial area is clipped and wiped with cotton saturated with alcohol. The rabbits are fastened to a bleeding board by means of straps to their four feet with the ventral surface exposed to the operator. A sterile cloth is placed over the rabbit and bleeding board with a window cut out over the area of the chest, thereby exposing the region to the operator. Cardiac puncture is made with an 18 gauge needle attached to a sterile 50 c.c. syringe, the syringe having previously

been rinsed with sterile double normal strength salt solution. Cardiac puncture is made from a point of insertion just left of the median line at the margin of the xyphoid cartilage. This line of entry to the heart is used in preference to that of entering between the 4th or 5th rib. It enables the operator to withdraw blood from the heart without passing through the lung. Cardiac puncture by this channel into the left ventricle is more direct and the mortality following bleeding has been noticeably reduced. Many operators may not prefer this method of bleeding. Several methods of withdrawing blood have been used, the first was by creating 8 to 10" of vacuum in a bottle to which was attached a syphon with a needle adapter. It was discarded, however, in preference of the syringe method, where the operator was able to determine the exact amount of blood being drawn from the heart. Fifty to 60 c.c. of blood are taken at each bleeding. The serum recovered has been approximately 60 per cent of the blood drawn. The blood is collected in tubes 500 mm. in length and 65 mm. in diameter. They conveniently hold approximately 800 c.c. of blood. The blood is permitted to clot at incubator temperature after which the serum is drawn off, centrifuged, if necessary, preserved with methiolate to a concentration of 1 to 10,000 and filtered through a Berkefeld N. candle. The serum from the remaining clot in each tube is pressed out by dropping weights that have been attached by means of a pin through a rubber stopper prior to sterilization. The blood is delivered to the tube through glass tubing that has a removable cotton and gauze closure. This enables one to handle the serum aseptically and has proved practical and entirely satisfactory.

The 1,000 rabbits considered in this report have been immunized for the production of Type I, II, V, VII, VIII and XIV antipneumococcic sera. The data reported are taken from this group as a whole, and cover 1 year only. It may be noted, however, that at the end of the time, a small percentage of the group remain.

From the original colony of 1,000 rabbits, 6,114 bleedings were made from June 30, 1937 to July 1, 1938. Of the 1,000 rabbits 421 died following bleeding. These deaths are directly attributable to bleeding and occurred within 24 hours following. Two hundred and two died during the course of immunization, and their death may be directly attributed to the injection of the bacterial suspensions. One hundred and forty-two died from other causes not asso-

CHART I—Distribution of 406 rabbit deaths due to bleeding

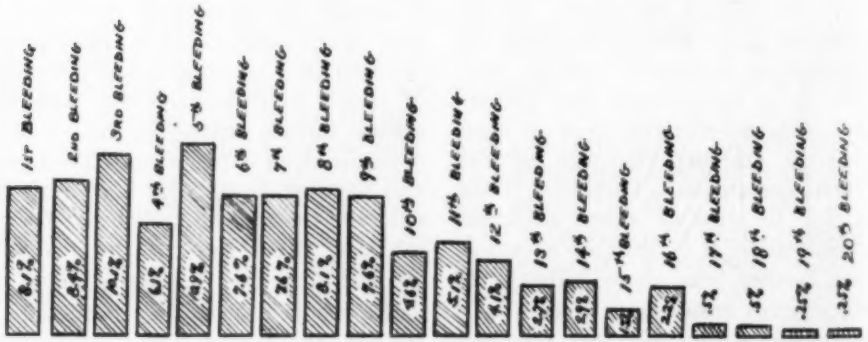
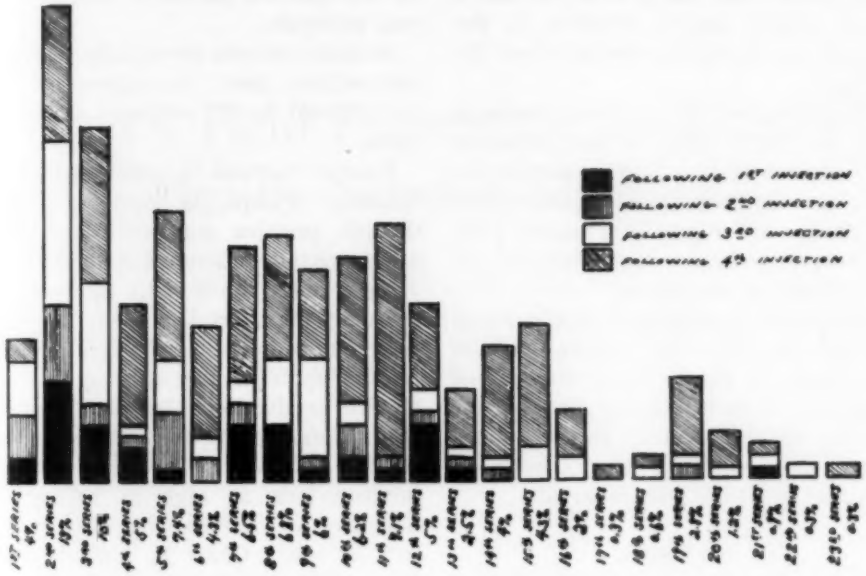


CHART II—Distribution of 324 rabbit deaths due to immunization



ciated with either bleeding or immunization. Injury has not been a factor in mortality rate.

It may be noted from the figures on mortality, considering the total number of deaths of rabbits from all causes that a rabbit in the colony has a life expectancy of approximately 9 bleedings.

During the year, 765 of the rabbits, or 76.5 per cent, died from all causes and 235, or 23.5 per cent, are in the colony and continue as producing rabbits.

For 1 year, exclusive of the rabbits remaining in the colony, 1 death occurred for each 14.5 bleeding. The 23.5 per cent of rabbits remaining in the colony however, may materially increase the number of bleedings per rabbit death.

The cost factor has not been discussed in connection with the production of type specific antipneumococcic rabbit serum. Simple calculations, however, will reveal the cost to be equal to, if not greater per c.c. than, antipneumococcic horse serum.

It may be noted from Chart I that the high mortality rate occurs during the first 10 bleedings. The percentages have been calculated on the basis of the number of rabbits dead following each bleeding compared to the total number of bleeding deaths. Of the 406 rabbit deaths due to bleeding, 8.1 per cent occurred with the first bleeding, 8.4 per cent with the second, 10.1 per cent with the third, and so on as represented. It is believed that the weaker rabbits not able to tolerate bleeding are self eliminating early in the program. The chart offers little other than the natural resistance of a colony to scheduled bleedings.

Chart II shows the distribution of 324 rabbit deaths due to immunization. The 324 deaths have been illustrated by columns showing the series of immunizations during which they occurred. The columns are subdivided to illustrate after which injection deaths occurred.

Each column and each column portion has been diagrammed from actual calculated percentages.

The second and third series of immunizations claim the greatest mortality, hence rabbits highly sensitive to the antigen are evidently weeded from the colony.

Beginning with the start of bleedings and the fourth series of immunization (see Immunization) it is interesting to note that the gradual rise in percentages of deaths are regularly reduced after each four series of immunizations by the scheduled rest period.

The relative per cent of deaths which follows the first and fourth injection of antigen in nearly every series is of interest. Before reducing the amount of the fourth injection in each series the rise in mortality after the fourth injection was more accentuated.

DISCUSSION

The management of a rabbit colony plays an essential part in the economical and successful production of immune sera.

Those responsible for production should arrange for their supply of rabbits from reliable sources. Purchases should be restricted to rabbits of desired weights, and of healthy stock. The rabbits should be individually caged and comfortably maintained under sanitary conditions, free from draughts. Feed should be of good quality, and sufficient to maintain the body weight of the rabbit in production. Fresh water supplied daily is a safe practice.

A satisfactory bacterial suspension is the prerequisite to an immune serum of satisfactory potency. This is first accomplished by maintaining the virulence of the type specific pneumococci, growing them in a suitable medium and for an optimum period of time to prevent autolysis.

Accurate records are equally essential and without them the scheme of production and results obtained are of no value.

Rabbits respond to careful handling. Bleeding technic is best developed through practice and each laboratory will develop its individual method, which is best suited to it with the hope of reducing the mortality from bleeding.

Immunization schedules may vary depending upon the plan of those responsible for production. Intense schedules of immunization are apparently responsible for a high mortality and may not produce sera as high in unitage as schedules less intense with longer intervals of rest. Chart I, however, indicates that the bleeding mortality is regularly higher following rest periods.

If less than 50 c.c. of blood is taken from the rabbit of 4 to 5 lbs., with no rest periods, the mortality following bleeding and immunization will be materially reduced. Further data may support this.

ACKNOWLEDGMENTS

The writer wishes to extend his appreciation to those who assisted in keeping records which made this report possible. John Hohenadel's efforts to obtain data in connection with this report are especially appreciated.

REFERENCES

1. Horsfall, F. L., Jr., Goodner, K., MacLeod, C. M., and Harris, A. H., 2nd. *J.A.M.A.*, 108:1483, 1937.
2. Loughlin, Elmer H., Bennett, Richard H., and Spitz, Samuel H. *J.A.M.A.*, 111:497, 1938.
3. Goodner, Kenneth, Horsfall, Frank L., Jr., and Dubos, Rene, Jr. *J. Immunol.*, 33:279, 1937.
4. Cole, Rufus, and Moore, Henry F. *J. Exper. Med.*, 26, 4:537, 1917.

Rural Field Experience for Public Health Nursing Students*

PEARL McIVER, R.N., F.A.P.H.A.

Senior Public Health Nursing Consultant, U. S. Public Health Service, Washington, D. C.

PROFESSIONAL education has gone through three stages in its development. The earliest was the apprentice stage where any one wishing to become a physician or a lawyer attached himself to a successful practitioner of his chosen career and, through observation and practice under his preceptor's direction, acquired the necessary training. Later the pendulum swung to the opposite side and practically all of the professional education curriculum was planned as intramural instruction.

The present-day trend in modern education, whether in the field of medicine, dentistry, law, cultural education, or public health, is toward a combination of theoretical instruction with practice under expert supervision as the most satisfactory plan for the preparation of any professional worker.

The objection to the apprentice system of education centered around the fact that the learner was required to do much that had little or no educational value in order to pay his instructor for the education he was supposed to receive. Frequently he was required to do certain types of work over and over long after he had mastered the technics. Others found that their training had been very one sided and that there were many fields in which they had had no training or experience.

Field experience, as a regular part of a university curriculum in public health nursing, is fraught with the same dangers as the old apprentice system. Students may be assigned to agencies where they are required to assist the organization by performing routine tasks over and over, day after day, and little or no effort is made to teach them the proper application of public health nursing principles. The agency may not be wholly to blame for this. The field agency may be required to take students without any remuneration, and a good field practice program costs money. Naturally the agency tries to get its remuneration from student work. Or, the agency may not be equipped to give a satsifactory educational experience, and in that case it should not have been selected by the university for that purpose.

It follows that the success of the student's field experience depends upon a number of factors:

Is the field agency organized on a sound administrative basis?

Is the program carried by the agency well balanced and typical of most health programs?

Are the members of the professional staff equipped to serve as instructors?

* Read at a meeting of the Committee on Professional Education at the Sixty-seventh Annual Meeting of the American Public Health Association, Kansas City, Mo., October 27, 1938.

Has the university, or some other department, arranged to reimburse the field agency for the expense of teaching students?

Are the students detailed to the agency for a sufficient time to make it possible for them to participate in all of the various phases of the health program?

Have arrangements been made to provide individual transportation for the students?

These, and many other questions, were asked of all of the universities and colleges in the United States which offer approved courses of study in public health nursing. Replies were received from all but 2 of those to which the questionnaires were sent. Three universities replied that they were not at present offering rural experience to their public health nursing students. Two of the colleges sent information about the state health department of their respective states rather than on the local health agencies, and thus the information was not comparable. Fairly complete returns were received from 10 colleges and universities, and the comparable information received from the

TABLE I

Rural Health Agencies Which Were Used for Field Experience by the Colleges and Universities Offering Approved Courses of Study in Public Health Nursing and the Number of Nursing Students Who Received Rural Experience During 1937–1938 *

College or University	*Number and Type of Agencies Used for Rural Field Experience*			*Total Number of Students Who Received Rural Experience During 1937–1938*
	County Health Department	*District Health Unit*	*County Nursing Service*	
University of California	4	1	1	20
Catholic University	1	—	—	1
University of Michigan	1	†	—	13
Wayne University	1	1	—	6
University of Minnesota	—	3	6	41
Western Reserve Univ.	4	—	—	23
University of Oregon	3	—	—	76
Peabody College	2	1	—	77
Vanderbilt University	1	—	—	18
Medical College of Virginia ‡	—	1	—	1
College of William & Mary ‡	—	**	—	12
University of Washington	9	—	—	49
Total	26	7	7	440

* Universities of Ohio, Pennsylvania, and Syracuse offered no rural field experience to public health nursing students last year. No replies were received from Simmons College and Columbia University.

† Two agencies used jointly with Wayne University

‡ Complete information on rural field training not available

** One agency used jointly with Peabody College

other 2 colleges was included in the final tabulations.

AGENCIES USED FOR RURAL FIELD EXPERIENCE

According to the information collected in this study, 40 different rural health agencies were utilized in giving rural field experience to 440 public health nursing students last year. Three of the agencies were used by two universities. Both the University of Michigan and Wayne University sent students to the Michigan Community Health Project (the project financed by the Kellogg Foundation) and to the Children's Fund of Michigan. Peabody College and the College of William and Mary both sent students to the rural teaching center in West Virginia. Therefore, in the preparation of the tables which follow, these agencies were counted but once, even though they were used by more than one university.

From Table I it will be seen that 26 of the agencies used for rural field experience were organized as county health departments, 7 were district health units, and 7 were county nursing services only.

Table II gives a very sketchy picture of the personnel employed by these agencies. All but 7 were under the direction of whole-time health officers; 28 employed full-time local nursing directors or supervisors; of the 12 which did not have local nursing supervisors, 5 were one-nurse services, 4 had but 2 nurses, and 3 had only 3 nurses; 31 employed one or more sanitation officers. The 7 county nursing services and 2 of the county health departments had no sanitation personnel.

A total of 273 staff nurses were employed by these 40 agencies. The size of the staff varied considerably. Five agencies had but 1 nurse, while 10 had staffs of 10 or more nurses.

A public health council or advisory health committee made up of community leaders and representatives of voluntary health agencies is considered by many health administrators to be a valuable and necessary adjunct to sound local health organization. Twenty-four of the 40 rural agencies had a local advisory group of some type. However, some of the advisory boards or councils were made up entirely of county or township officials, and others represented only professional groups such as medicine and dentistry.

It is generally agreed that a good teaching agency should be one which is a "going concern" and has a well developed program. More than half of the 40 rural agencies had been in operation 10 years or more. However, 8 of them had been organized during the last 3 years and may not have had time to become stable organizations.

QUALIFICATIONS OF STAFF

While no attempt was made to secure information on the qualifications of any of the health department staff except the nurses, it is recognized that the health officer and other personnel must be well qualified public health workers if the nursing student's experience is to be satisfactory.

Of the 28 nursing directors or supervisors who were employed by these rural health departments, all of them were high school graduates, and 19, or about 68 per cent of them, had academic degrees. Twenty-three, or about 82 per cent, had certificates in public health nursing or had completed an equivalent amount of work in an approved public health nursing course of study; 11, or about 41 per cent, had had special preparation in supervision of public health nursing (Table III). Several had had special training in obstetrics, venereal disease control, or tuberculosis work.

Of the 273 staff nurses who were employed by these agencies, only 4, or less than 2 per cent, had not completed

TABLE II

Personnel of the Rural Health Agencies Which Were Used for Public Health Nursing Experience During 1937–1938 by the Colleges and Universities Which Offered Approved Courses of Study in Public Health Nursing *

College or University	Total Agencies Used for Rural Experience	Number of Rural Health Agencies Having: A Whole-time Health Officer	A Nursing Supervisor or Chief Nurse	One or More Sanitation Officers	A Nursing Staff of: Only 1 Nurse	2 to 5 Nurses	5 to 10 Nurses	10 or More Nurses
University of California	6	5	4	4	—	2	1	3
Catholic University	1	1	1	1	—	—	1	—
University of Michigan	1†	1	1	1	—	1	—	—
Wayne University	2	2	1	1	1	—	1	—
University of Minnesota	9	3	4	3	4	1	1	3
Western Reserve	4	4	4	4	—	2	1	1
University of Oregon	3	3	3	3	—	—	3	—
Peabody College	3	3	3	3	—	1	1	1
Vanderbilt University	1	1	1	1	—	—	1	—
Med. College of Virginia	1‡	1	1	1	—	—	—	1
William & Mary ‡	**	—	—	—	—	—	—	—
University of Washington	9	9	5	9	—	7	1	1
Total	40	33	28	31	5	14	11	10

* Universities of Ohio, Pennsylvania abd Syracuse offered no rural public health nursing experience last year. No replies from Columbia University and Simmons College.

† Two services used jointly with Wayne University

‡ Information on all rural training facilities not available

** One service used jointly with Peabody College

high school. One hundred and ten had academic degrees and 218, or about 80 per cent, had completed an accredited course of study in public health nursing. In addition, 10 of the staff nurses had had special courses in supervision, 20 had had additional work in tuberculosis control, 8 had had special courses in venereal disease work, 9 had had special pediatric work, 6 special preparation in orthopedics, and 2 special courses in obstetrics.

From a comparison of the qualifications of the nurses employed by these agencies with the data obtained from former studies of the qualifications of nurses in official agencies, it would appear that agencies having staffs with superior qualifications had been selected for rural public health teaching centers.

TABLE III

A Comparison of the Qualifications of Nurses Employed in 40 Rural Teaching Centers in 1938 With Those of Official Public Health Nurses Who Were Included in Two Previous Studies Made by the N.O.P.H.N.

	Per cent of Nurses Having Each Qualification		
Education	*N.O.P.H.N. Survey of Public Health Nursing 1931 (634 nurses)*	*N.O.P.H.N. Study of Personnel Practices in Official Agencies 1936 (917 nurses)*	*Nursing Personnel in 40 Rural Agencies Used for P.H.N. Field Experience 1938 (301 nurses)*
High School Graduate			
Directors	57.6	33.3	100.0
Supervisors	55.2	61.9	....
Staff nurses	51.7	87.7	98.5
College Degree			
Directors	21.2	61.0	67.9
Supervisors	5.7	37.1	....
Staff nurses	2.3	5.0	40.3
Public Health Nursing Certificate			
Directors	45.5	72.2	82.1
Supervisors	25.3	90.7	....
Staff nurses	8.0	19.0	80.0

PROGRAMS OF AGENCIES GIVING RURAL PUBLIC HEALTH NURSING EXPERIENCE

All agencies reported that their programs included the control of acute communicable diseases, and home visiting in the control of tuberculosis and venereal diseases. Twenty-eight, about 74 per cent, included diagnostic clinics for tuberculosis in their programs, and 21, or about 55 per cent, conducted venereal disease treatment clinics.

All of the agencies included maternal hygiene in their programs, but none offered a complete maternity nursing service including nursing assistance at delivery. Only one reported no prenatal visiting. All reported postpartum visiting, but in the majority of cases it would appear that these visits were made in connection with the infant health supervision visits and that no actual postpartum nursing care was given. Fourteen stated definitely that no bedside nursing care was given even as a demonstration. All of the remaining agencies stated that nursing care was given in emergencies and for demonstration purposes.

All carried an infant health supervision program but in 11 this service was confined to nursing visits to the homes, no group conferences or medical clinics being held. All included a school health service. All but 6 of the 40 reported that the nurses carried on some type of group teaching either in the high schools or with adult groups.

In general, it may be said that with the exception of nursing care to the sick, the rural agencies appear to carry a more completely generalized public health program than do many of the city agencies which have been used for student field experience. However, a really complete program in any of these services may not be possible when the population which each of the rural staff nurses is expected to serve is taken into consideration. The smallest population served by any one nurse in the group of agencies was 5,000, and in some there was but 1 nurse to 30,000 people. Obviously, regular maternity and bedside

nursing services would not be possible under those conditions, and it is probable that some of the other services were spread rather thinly.

RELATIONSHIP OF FIELD AGENCY TO THE UNIVERSITY

Eight of the universities and colleges offering rural field experience to public health nursing students appoint the supervising nurse of the field agency to the teaching staff of the university. Three of the universities employ full-time field instructors who work closely with the field agencies, coördinating the student's field experience. The educational supervisor of the state health department who has an appointment to the teaching staff of the university serves in this capacity in one state.

While all of the universities and colleges require the students to pay tuition for field experience, only 13 of the 40 field agencies received any remuneration from the university for the field teaching which they provided. The amounts received by the 13 agencies which were remunerated varied astonishingly. Several received a flat grant of $600 a year without regard to the number of students; 1 received a grant of $1,300 annually, and another 25 per cent of the salary of the nursing supervisor, 16 per cent of a staff nurse's salary, and 20 per cent of the salary of an office clerk. Several of the universities reimburse the field agencies by giving them a percentage of the tuition paid to the university. On a student basis, the fees received by the rural field agencies ranged from $7.50 to $85 a month! The median fee for each student per month was $30. This was also the mode or the sum which was most frequently paid by the university to the field agency for field experience.

RATIO OF STUDENTS TO STAFF

It was encouraging to note that no agency had more students assigned to it, at any given time, than the number of staff nurses. Nine agencies reported that, at certain times during the year, there were as many students on duty as there were staff nurses; but from the total number of students assigned for the year, it was apparent that the student load was not continuous. There were periods when there were no students assigned. The other agencies reported a ratio of less than one student per staff nurse.

LENGTH OF PERIOD FOR RURAL FIELD EXPERIENCE

The period for which students were assigned to rural agencies for field experience varied from 1 to 14 weeks. The majority of the agencies stated that students were assigned to them for 4 weeks. The University of Oregon stated that 4 weeks had been the usual time assigned to rural experience but that beginning this fall (1938), students would devote to it an entire quarter (11 weeks). The University of California has usually required an entire quarter's work with a rural agency. Western Reserve University has arranged for 1 week of observation for all students and a 6 weeks' experience with a rural agency for students who elect rural work.

TRANSPORTATION OF STUDENTS WHILE IN RURAL FIELD

"Field experience" implies actual participation in the field work. Field observation naturally precedes actual participation in the work; but unless the student is given an opportunity to carry certain responsibilities and serve as a member of the staff the experience is of less value. In rural areas it is essential that some provision be made for transportation if the student is to have an opportunity to function as a staff worker.

Of the 40 agencies on which informa-

tion was obtained, very few reported an adequate plan for providing transportation. Vanderbilt University owns several cars which are assigned to Rutherford County (which serves as the rural field for that school); these are used by the students, and by the staff of the health department during the student's observation period. Two of the universities pay for gasoline and oil for students who have their own cars. Two of the agencies in California furnish cars for student use. Students are assigned to these agencies for 14 weeks' experience, so are more capable of doing individual work than are those who stay but 1 month. A number of the agencies reported that the students owned and operated their own cars. Students who receive a stipend from Social Security funds are sometimes expected to use a part of their stipends for this purpose. The majority of the agencies reported no regular plan for transporting students, and stated that the student merely traveled with one of the regular staff.

SUMMARY AND CONCLUSIONS

The following principles are considered by many public health nursing educators to be desirable in establishing a rural field experience center:

1. The agency selected should be an organized county or district health department which has developed a well rounded health program. All personnel employed by the agency should meet the minimum qualifications for their various types of work.

2. There should be at least one whole-time nursing supervisor responsible for the student program who is eligible for faculty appointment in the college or university with which the agency is affiliated. If there are more than 6 or 7 staff nurses a second supervisor, to function in an educational capacity, should be provided.

3. A satisfactory relationship between the agency and the university should be worked out which would:

   a. Provide reasonable compensation to the health agency for the field teaching
   b. Give the health officer and supervising nurse faculty appointments in the university as field instructors
   c. Establish a regular plan for conferences on student experience between the faculty of the university and the supervisory staff of the field agency

4. The number of nursing students assigned to the field agency at any one time should never exceed the number of staff nurses employed by the agency. It is preferable not to have a continuous student load. Periods when no students are assigned to the agency are highly desirable.

5. The student should be assigned to the agency for at least 6 weeks of continuous experience, and preferably longer.

6. The student's experience should include both observation and actual participation in all phases of the health program. This requires some specific provision for student transportation.

In checking over the present facilities for rural experience for public health nursing students, it appears that:

1. The majority of the agencies now used for this purpose meet the minimum requirements in so far as organization is concerned. All but 7 of the 40 agencies are organized health departments under the direction of whole-time health officers. However, 9 of the agencies had no sanitation personnel.

2. The programs carried by the various agencies are fairly general and cover the usual health department activities. However, there is need for an increase in the number of staff nurses employed by all of the agencies if each nurse is to have a reasonable case load. No nurse can carry on a satisfactory generalized public health nursing program if she is serving from 10,000 to 30,000 people. There is need for more emphasis on the giving of nursing care, particularly as a demonstration, if the service rendered is to be really effective.

3. Only 28 of the 40 agencies provided full-time local nursing supervisors. Naturally an agency cannot provide a supervisor for a staff of one or two nurses. There are certain advantages in having experience in the smaller and less complex agencies. If the local staff nurse is well qualified as a teacher, as was the case in one or two of the one-nurse counties, the situation may be satisfactory. However, the population per nurse was so great in most of the one or two nurse agencies that it is difficult to see when the staff nurse had time for supervising a student.

4. The qualifications of the nursing per-

sonnel were exceptionally high. Practically all of the staff met the minimum qualifications recommended by the Professional Education Committee of the American Public Health Association, and many of them exceeded those qualifications. The majority of the supervisors and a large percentage of the staff nurses would qualify for faculty appointment to a university although only 8 universities have adopted that practice.

5. The number of students assigned to the agency at one time appears to be satisfactory. No agency admitted more students at one time than it had staff nurses. In the majority of the agencies the ratio was less than one student to one staff nurse.

6. Only one university assigned students to the field agency for less than 1 month. One month was the most frequent assignment made last year, but 2 universities indicated that students would be assigned to the rural agencies for longer periods beginning this year.

7. Very few universities or agencies have worked out a satisfactory plan for the transportation of students. If the student always accompanies a staff nurse, there is little opportunity for individual student practice. A satisfactory plan for student transportation is a universal need.

8. Twenty-seven of the 40 agencies which provided rural experience for public health nursing students last year did so without any remuneration from the university. A good teaching program is expensive. The university cannot expect teaching of good quality from volunteer instructors. In some of the states, the state health department gives additional aid to the agency used for field training. Since a well organized field teaching center may be used by the state health department for a variety of useful purposes, such a plan may be a partial solution of the problem. At any rate, it must be remembered that the health department's first obligation is to the community. Unless good service to the community is the first objective of the field agency, it is not likely to have a program that is worth while for student experience.

THE APRIL JOURNAL
WILL BE A
SPECIAL BOOK ISSUE

A review of outstanding books of the past year
by Mazÿck P. Ravenel, M.D.

Reviews and announcements of many new books

Use it for reference and as a guide in book-buying

Place of the Methylene Blue and Resazurin Reduction Tests in a Milk Control Program*

C. K. JOHNS, PH.D.

Senior Assistant Scientist (Bacteriology), Science Service, Dominion Department of Agriculture, Ottawa, Ontario

THE control of raw milk supplies rests largely upon frequent routine bacteriological examination. Opinions may differ concerning the relative value of the three official tests (plate count, direct microscopic count, and methylene blue reduction test), yet when used with a proper appreciation of their limitations, each can assist in bringing about a considerable improvement in quality.

For the ordinary run of milk for pasteurization the plate count is practically disqualified by reason of greater cost and delay in obtaining results. There is also evidence that it is a less reliable indicator of utensil contamination than is the Breed count or reduction test.[25] The Breed smear without question furnishes the most complete information, both qualitative and quantitative. It is at its best with the very poor milks, declining in accuracy as the count decreases.[19, 28] As milk supplies improve, therefore, a stage is reached where doubtful reliance can be placed upon the Breed count without greatly increasing the number of fields examined. This stage has already been reached in some cities. The need for a technically trained worker and expensive equipment, as well as the fatigue involved, are also factors tending to limit the use of this method. The reduction tests, on the other hand, do not involve expensive equipment, fatigue, or technical workers. They are well suited to the examination of large numbers of samples, and since the poorest milks reduce first, a check-up at the farm may be made without delay.

While extensively employed in the dairy industry, the methylene blue reduction test has receiver more limited acceptance by milk sanitarians on this continent. Doubtless this is due largely to the feeling that the reduction test, since it does not always correlate exactly with the bacterial count, is not sufficiently reliable for official control. In view of the fact that there is no method available for determining with perfect accuracy the actual number of bacteria present, and of the evidence accumulating concerning the

* Read before the Laboratory Section of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 28, 1938.

Contribution No. 54 (Journal Series) from the Division of Bacteriology, Science Service, Dominion Department of Agriculture, Ottawa.

degree of error inherent in the counting methods commonly employed,[10, 11, 15, 21, 22, 30, 31] this attitude becomes increasingly difficult to justify.

While the dairy industry is interested in the methylene blue reduction test chiefly as an indicator of keeping quality, it is recognized that in official milk control current interest centers upon the established general relationship between reduction time and initial bacterial content.[16, 23] Although discrepancies between reduction times and counts are not infrequently due to errors in the counting methods employed, it should be recognized that there are various factors which tend to disturb this relationship.[7] Many of these are uncontrollable and their importance in practice has yet to be established. There are good reasons for believing that the most important factor, and one which *is* controllable, is the sweeping of varying proportions of the bacteria to the surface with the rising fat globules. The extent of the error thus introduced increases as the reduction time is prolonged, and has resulted in the feeling that the test is not reasonably accurate beyond the 5½ hour period.[23, 24] Where steps are taken to redisperse the fat globules and accompanying bacteria at intervals during incubation, reduction time is generally shortened, significant variations between replicate tubes disappear, and decolorization is uniform throughout the tube.[3, 6, 7, 23, 27, 30] On the recommendation of Wilson,[30] a modified test, the chief feature of which is the inversion of the tubes every 30 minutes, has been adopted in England for the official analysis of graded raw milks.[12] Frayer [3] and Johns [7] have published data favoring the modified test, but Thornton [26, 27] opposes its adoption on this continent on the grounds that the accuracy of the test is not significantly increased thereby, while the technic is complicated unduly. Although formerly contending that mixing at intervals will lead to more accurate results with good milks,[23, 24, 25] Thornton [26] now states that "neither test greatly excels the other in accuracy, despite the greater variability displayed in the standard test which may lead to inaccuracy in evaluating an individual milk." This opinion is mainly based upon the high coefficient of correlation (0.94 ± 0.004) he reports for the two tests.

Although admitting that "the variability displayed by the standard test may lead to inaccuracy in the case of an individual sample," Thornton appears to overlook the fact that it is not the *average* for a *series* of samples, but the reliability of the values obtained for each *individual* sample, with which we are concerned. He also appears to overlook a point of fundamental importance in any discussion of the relative accuracies of the two tests. Whether regarded as an index of initial bacterial content or of keeping quality, the test will obviously be most accurate where it reflects the oxygen consuming activity of *all* of the bacteria growing in the milk. This can only be done where the bacteria remain uniformly dispersed throughout the milk, and we may regard this as the *true* reduction time. Under the standard technic, however, we actually measure the time required by the highly variable fraction of the total bacteria not swept to the surface [9] to reduce the dye in the body of the milk. Any practicable modification of technic whereby a more uniform dispersion is maintained should yield results more nearly approaching the *true* reduction time and may consequently be regarded as more accurate than the standard test.

While the results with different samples are not strictly comparable because of variations in the interval between the last inversion and the preparation of the smears, the data in

TABLE I

Influence of Hourly Inversion of Tubes Upon Number of Bacteria in Body of Milk

Sample No.	Methylene Blue Reduction Time (hrs.) [1]		Ratio Standard / Modified	Interval Between Last Mixing and Making Smear (Minutes)	Direct Microscopic Count in Millions per ml.[2]				
	Standard	Modified			A	B	C	D	E
57	11½	4	2.75	90*	1.31*	28.4*	0.51*	37.3*	170
39	13	6¾	1.93	45	75.1	79.6	1.48	46.0	259†
2	13¼	7¼	1.83	75	38.1	71.0	2.95	60.0	139†
48	11¼	6¾	1.68	45	95.9	103.5	2.13	42.8	271
49	10¾	6¾	1.56	45	47.6	43.0	3.25	33.3	144
51	8½	5¾	1.45	45	46.1	46.0	12.8	36.5	166
12	5¾	4	1.44	60	6.47	23.0	1.27	30.4	67.4
42	8¾	6½	1.34	30	16.8	27.7	4.5	56.8	136
62	3¾	3	1.25	60	42.2	56.5	28.5	44.0	74.9
8	4¾	4	1.18	60	52.5	33.2	5.0	38.9	42.2
Average—top 3 samples					38.4	59.7	1.65	47.8	189
bottom 3 samples					37.2	39.1	12.7	46.6	85.3
all samples					42.78	51.19	5.74	42.6	146.95

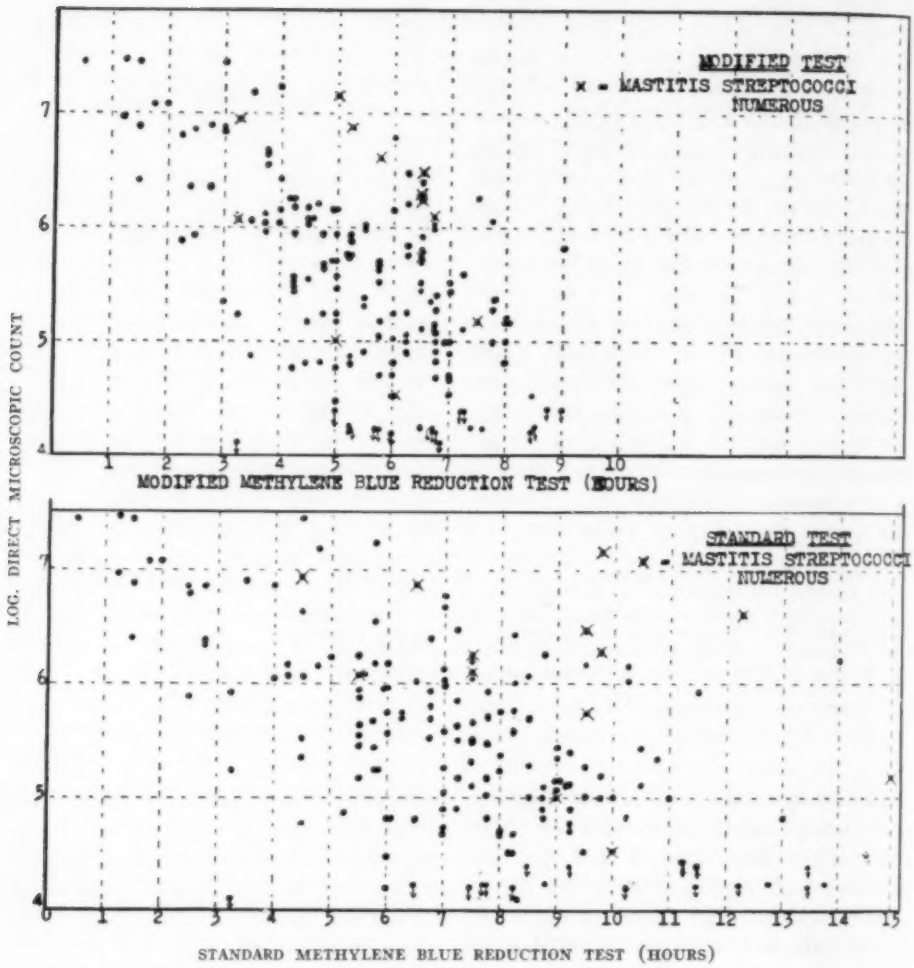
A=Modified test at time of reduction; body of milk before shaking
B=Modified test at time of reduction; after shaking vigorously
C=Standard test at same moment as A and B; body of milk before shaking
D=Standard test at same moment as A and B; after shaking vigorously
E=Standard test at moment of reduction; after shaking vigorously
[1] Average of triplicate tubes. Modified test—tubes inverted hourly
[2] 60 fields counted (individual cells)
* Smear prepared at 4½ hrs.
† Smear prepared at 11½ hrs.

Table I indicate that hourly mixing does bring about more uniform distribution of bacteria. It will also be observed that significantly larger numbers of bacteria are required to bring about reduction in the standard test (E), while there is less uniformity in such counts than in those at the moment of reduction in the modified test. Lastly, attention should be drawn to the wide differences in the ratios of standard to modified reduction times. Such differences have been found to be characteristic of milks from certain herds,[7] and are related to differences in the intensity of creaming. While the limitations of the direct microscopic method are responsible for some discrepancies, the differences are sufficiently great to warrant the conclusion that the modified test reflects the initial bacterial content much more accurately than does the standard test.

Another way of comparing the accuracies of the two tests as a measure of bacterial numbers is to observe the correlation between the initial direct microscopic count and the reduction time. Data from 171 samples presented in Figure I indicate definitely less scatter with the modified method, particularly in the case of samples showing large numbers of mastitis streptococci. In view of the current interest in mastitis, this feature is deserving of consideration.

In those areas where control work is confined to the detection of the poorest milks there will be little interest in the modified test. Where higher standards are set, the improved accuracy and shortened reduction time of the modified test should commend it. Since there is satisfactory agreement

FIGURE I


MODIFIED TEST
× - MASTITIS STREPTOCOCCI NUMEROUS
LOG. DIRECT MICROSCOPIC COUNT
MODIFIED METHYLENE BLUE REDUCTION TEST (HOURS)
STANDARD TEST
× - MASTITIS STREPTOCOCCI NUMEROUS
STANDARD METHYLENE BLUE REDUCTION TEST (HOURS)

between inversion at ½, 1, and 2 hrs.,[8] a 2 hour inversion program would permit classification into 4 grades by observing the tubes after 2, 4, and 6 hrs.* This would avoid Thornton's objection that inversion of the tubes complicates the technic unduly.

Mention has been made of certain shortcomings of the methylene blue reduction test. To complete the picture, let us consider some of its specific advantages. Since a much larger portion of milk is examined,† it avoids the serious errors frequently met with in the counting methods as a result of the uneven distribution of the organisms in the milk.[9, 19, 30] Again, the clumping of organisms has little or no influence upon reduction time, while the plate count, and to a lesser extent the direct microscopic count, are seriously affected.[15, 19, 28, 30] Finally, the reduction test is sensitive to the state of

* These grade limits correspond to *average* standard reduction times of 2, 5, and 8½ hrs.[8]

† 50,000 to over 200,000 times as great as in the direct microscopic method and 1,000 to 100,000 times as great as in the plate count.

activity of the organisms,[19, 30] which the counting methods fail to reflect.

With rare exceptions, milk sanitarians have thought of bacteriological quality exclusively in terms of numbers. Admittedly there is a definite relation between care in production and handling and the bacterial content. There is also a definite but less well recognized relation between cooling practices and the state of activity of the organisms. It has been shown [19, 30] that the reduction test is sensitive to metabolic activity during the lag phase of growth, while the plate count is not. Few would contend that a sample was of equal quality at the beginning and end of the lag phase even though the count remained the same. Since faulty cooling practices are the chief cause of high count milks it seems only reasonable to regard the sensitivity of the reduction test to the state of activity of the organisms as an advantage not possessed by counting methods. After all, the consumer is primarily interested in keeping quality, which is a reflection of both numbers and activity of the organisms. The employment of the reduction test in official control would therefore tend to place more emphasis upon the state of activity of the organisms, a feature which many believe has not received adequate recognition.

THE RESAZURIN TEST

There is considerable current interest in the resazurin test.[1,2,4,5,13,14,17,18,19,20,29] The chief advantages claimed are: (a) it will furnish as much information after 1 hr. of incubation as will the older test after 5 to 7 hrs., and (b) it will more readily detect physiologically or pathologically abnormal milks.

While cognizant of its limitations, especially with low-count milk,[19, 21] we

FIGURE II

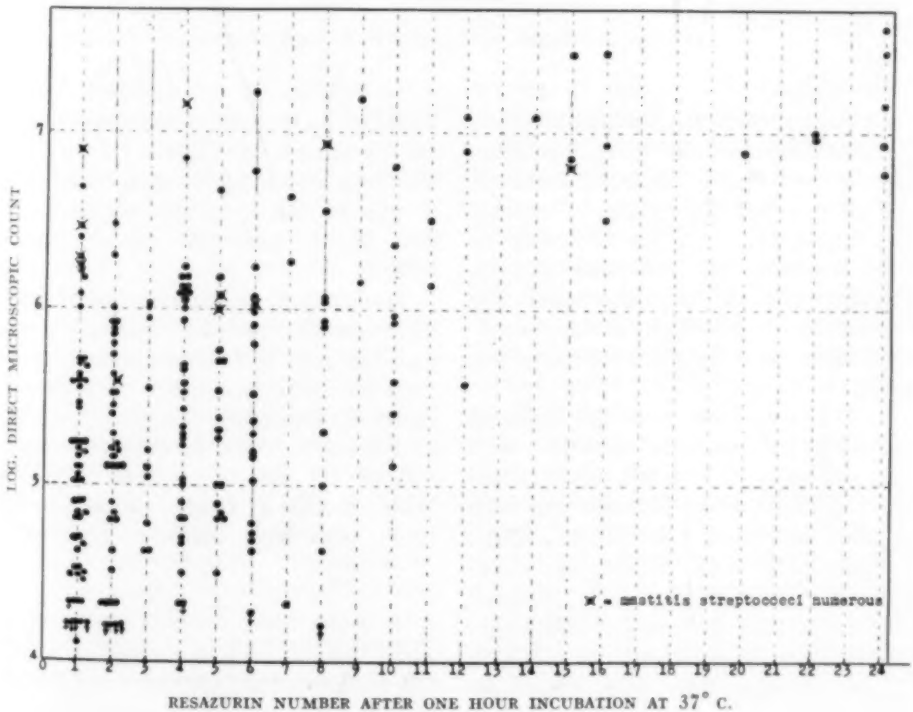
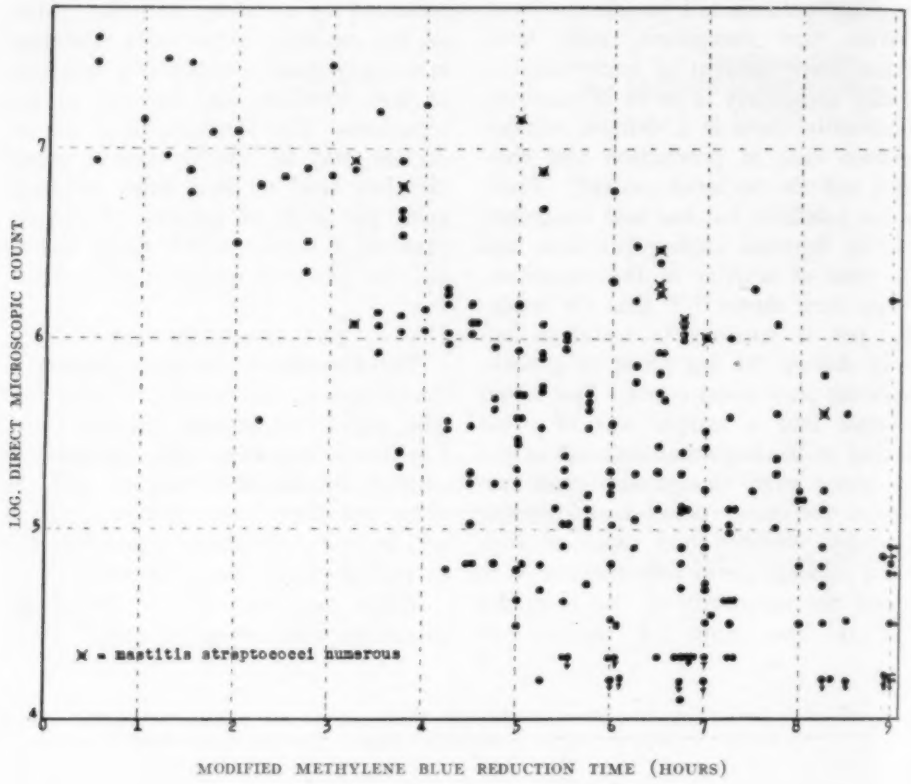

LOG. DIRECT MICROSCOPIC COUNT
7
6
5
4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
× = mastitis streptococci numerous
RESAZURIN NUMBER AFTER ONE HOUR INCUBATION AT 37° C.

FIGURE III



have chosen the Breed count as the basis for assessing the value of the resazurin test as an index of bacterial numbers. An attempt has been made to increase the accuracy by counting 80 fields. In both resazurin and methylene blue reduction tests the creaming error was minimized by inverting the tubes every two hours, until incipient reduction was noted.

It was expected that the reported sensitivity of resazurin to milks with high cell counts [1, 17] would seriously disturb the correlation between resazurin number and count, but in our studies (Figure II) this appears to have exerted little influence. Instead, the correlation is poorest with milks showing the least change in resazurin color. Comparable data from the modified methylene blue reduction test are presented in Figure III. While there is a considerable degree of scatter, it appears that the latter test indicates the initial bacterial content more reliably.

The available evidence suggests that, with certain samples, resazurin will react to high cell counts more readily than will methylene blue.* It will not, however, invariably detect such milks, as Ramsdell's data, as well as our own (Table II) clearly indicate. On the other hand, a larger proportion of milks with high bacteria counts will

* Since abnormally high cell counts are not infrequently encountered in milk from cows showing no definite evidence of mastitis, it may be open to question whether the condemnation of such milks by the resazurin test is justifiable.

TABLE II

Sensitivity of Resazurin and Methylene Blue Reduction Tests to Market Milks With High Cell Counts

Sample No.	Direct Microscopic Count [1] per ml.		Resazurin [2] Color Number at 1 Hr.	Methylene Blue [3] Reduction Time (hrs.)
	Cells	Bacteria		
E4	2,290,000	1,700,000*	1	6½
C37	2,130,000	143,000	6	5¾
E20	2,060,000	8,500,000*	8	3¼
C39	1,650,000	255,000	10	6¾
E5	1,590,000	113,000	1	6¼
A11	1,510,000	42,000	8	7¼
E11	1,460,000	1,030,000	1	6¾
D12	1,360,000	48,000	6	7
C5	1,310,000	32,000	6	5
B6	1,250,000	42,000	1	7¼
E29	1,200,000	48,000	4	5¼
E9	1,180,000	32,000	1	6
A26	1,140,000	21,000	4	7
A27	1,020,000	21,000	2	5½
A19	1,020,000	21,000	6	6¾
A14	995,000	105,000	4	7¼
C49	910,000	96,000	5	7¾
A9	863,000	21,000	7	6¾
B12	863,000	21,000	1	6
A24	765,000	42,000	3	7¼

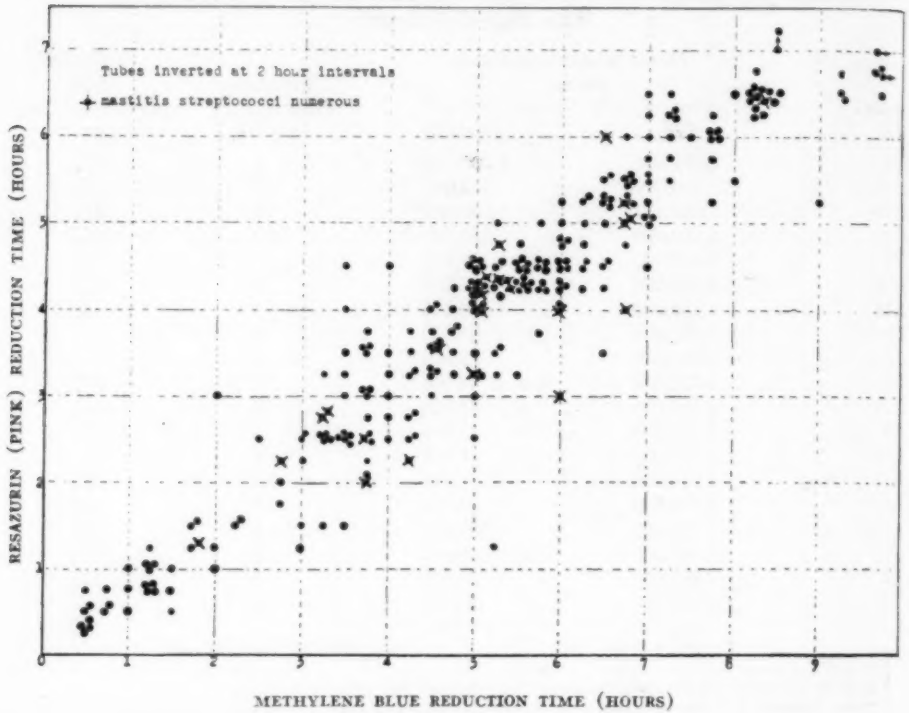
[1] 60 fields counted
[2] Numbers represent shades between initial color (0) and full pink (16)
[3] Tubes inverted at 2 hr. intervals until incipient reduction noted
* Long chain streptococci preponderant

escape detection by the resazurin test. Microscopic examination of milks showing marked change in 1 hr., as recommended by certain workers [1, 4] increases the diagnostic value of the test as regards mastitis, etc., but fails to compensate for the weakness just referred to.

In our studies of resazurin, observations were continued to the point of complete decolorization. Further analysis of the data disclosed a surprisingly close correlation between the time required to reduce resazurin to the pink stage and the methylene blue reduction time (Figure IV). Using this pink stage as the end-point, the incubation period is about three-quarters of that required to reduce methylene blue. When employed in this manner, rather than as a 1 hr. test, the resazurin test appears to furnish a satisfactory index of bacteriological quality.

Whether or not resazurin will replace methylene blue remains to be seen. In spite of such shortcomings as sensitivity to light,[4, 13, 17, 20] difficulty of obtaining satisfactory color standards,[1, 13] difficulty experienced by some operators in distinguishing shades of color,[1] and lack of sensitivity to dormant organisms in well cooled milk,[9, 17] several directors of plant laboratories [1, 13] feel that the 1 hr. test may replace the methylene blue test for the grading of milk. Our own findings incline us to agree with Frayer [4] and Ritter [18] that the 1 hr. test is not sufficiently reliable for this purpose. When, however, incubation is continued to the pink stage, resazurin appears to be equally as reliable as methylene blue, while possessing an

FIGURE IV—RELATION BETWEEN METHYLENE BLUE REDUCTION TIME AND TIME REQUIRED TO REDUCE RESAZURIN TO THE PINK STAGE (261 MARKET MILKS)


Tubes inverted at 2 hour intervals
+ mastitis streptococci numerous
RESAZURIN (PINK) REDUCTION TIME (HOURS)
METHYLENE BLUE REDUCTION TIME (HOURS)

important advantage in the shortening of the reduction period.*

Considerable further research must be undertaken before our knowledge of the chemistry of resazurin and its reactions in milk will be comparable to that concerning methylene blue. Until that stage is reached it seems best to defer final judgment concerning the place of the resazurin test in the field of milk control.

SUMMARY AND CONCLUSIONS

For routine testing of incoming supplies, the methylene blue reduction test has many advantages over the usual counting methods.

The accuracy of the test as an index of the initial bacterial content of the better grades of milk is greatly improved where the organisms are redispersed by periodical inversion. Inversion of tubes every 2 hrs. yields results in good agreement with those from more frequent mixing.

The resazurin 1 hr. test does not indicate the bacterial content as reliably as does the modified methylene blue reduction test. The former places a larger proportion of high count milks in the highest grade. When incubation is continued to the pink stage, the accuracy of the test compares very favorably with that of the methylene blue test, while the reduction time is shortened.

The correlation between resazurin color and cell count is much poorer with market milks than with individual quarter samples. Many market milks with high cell counts fail to bring about a significant color change.

* When inverted every 2 hrs. to redistribute the bacteria, milks reducing methylene blue in 8 hrs. by the standard technic will on the average reduce resazurin to the pink in around 4 hrs.

NOTE: The author desires to acknowledge the helpful coöperation of R. K. Howson, B.S.A., in the laboratory studies, and to express his thanks to Dr. A. G. Lochhead, Dominion Agricultural Bacteriologist, for helpful suggestions in the preparation of this paper.

REFERENCES

1. Barrett, W. D., Rutan, H., and Keenan, J. A. The Resazurin Test—Its Use and Practicability as Applied to the Quality of Raw Milk. *J. Dairy Sci.*, 20:705–709, 1937.

2. Demeter, K. J., und Forg, J. Betrachtungen über die Reduktaseprobe und die Brauchbarkeit von Methylenblau und Azurufin. *Deutsch. Molk. Zeit.*, 55:1383–1384, 1934.

3. Frayer, J. M. Dyes and Methods as They Affect the Methylene Blue Reduction Test. *Vermont Agri. Exper. Sta. Bull.*, 424, 1937.

4. ——— The Resazurin Test—A Preliminary Study. *Vermont Agri. Exper. Sta. Bull.*, 435, 1938.

5. Jenkins, H. A Study of the Resazurin Test as Applied to Cream. *J. Dairy Sci.*, 21:141–142, 1938.

6. Johns, C. K. A Modification of the Methylene Blue Reduction Test and Its Comparative Value in Estimating Keeping Quality of Milk. *Sci. Agri.*, 11: 171–190, 1930.

7. ——— Concerning the Accuracy of the Methylene Blue Reduction Test. *J. Dairy Sci.*, 21:227–237, 1938.

8. ——— Factors Influencing the Reduction of Methylene Blue in Milk. *Sci. Agr.* (in press).

9. ——— Unpublished findings.

10. Malcolm, J. F. The Plate Method of Estimating the Bacterial Content of Milk. The Limitations of Procedure in Common Use, with Suggested Improvements. *J. Dairy Res.*, 4:91–104, 1932.

11. Mattick, A. T. R., *et al.* The Plate Count of Milk. *J. Dairy Res.*, 6:130–147, 1935.

12. Ministry of Health (England) *Memo. 139—Foods*, 1937.

13. Moldavan, A. The new "One Hour" Test for Quality Milk. *Canad. Dairy & Ice Cream J.*, 15:21–22, 1936.

14. ——— The Resazurin Test. *Vermont Dairy Operators' and Managers' Assoc.*, 16:50–52, 1937.

15. Orla-Jensen, S., und Faulenborg, G. Über das Problem der Keimzählung. *Zentralbl. f. Bakt.*, II, Abt., 97:387–389, 1938.

16. Rahn, O. Die Grenzen der Reduktaseprobe für die Milcharbeiten. *Milchwirtsch. Zentr.*, 49:287–315, 1920.

17. Ramsdell, G. A., *et al.* Investigations of Resazurin as an Indicator of the Sanitary Condition of Milk. *J. Dairy Sci.*, 18:705–717, 1935.

18. Ritter, P. Beiträge zur Methodik der Haltbarkeitsprüfung. *Milchwirtsch. Zentr.*, 66:334–8, 1937.

19. Robertson, A. H., and Frayer, J. M. Variability, Accuracy and Adaptability of Some Common Methods of Keeping Quality. *Vermont Agri. Exper. Sta. Bull.*, 314–318, 1930.

20. Schwarz und Seeleman, M. Reduktaseprobe mit Azurufin zur Beurteilung der Frischmilch. *Deutsch. Molk. Zeit.*, 57:1417–19, 1936.

21. Strynadka, N. J., and Thornton, H. R. The Accuracy of the Direct Microscopic (Breed) Count of Bacteria and Leucocytes in Milk. *J. Dairy Sci.*, 20:685–92, 1937.

22. Tiedeman, W. D. An Extensive Test of Variations in Bacteria Counts on Identical Milk Samples. *Proc. 22nd Ann. Conv. Internat. Assoc. Dairy & Milk Insp.*, 225–236, 1933.

23. Thornton, H. R., and Hastings, E. G. Studies on Oxidation-reduction in Milk. The Methylene Blue Reduction Test. *J. Dairy Sci.*, 13:221–245, 1930.

24. Thornton, H. R. The Use of the Methylene Blue Reduction Test. *Canad. Pub. Health J.*, 24:192–196, 1933.

25. Thornton, H. R., *et al.* Milk Contamination and the Methylene Blue Reduction Test. *Canad. Pub. Health J.*, 25:284–294, 1934.

26. Thornton, H. R. Modified Methylene Blue Reduction Technic. *A.J.P.H.*, 27:791–792, 1937.

27. Thornton, H. R. A Comparison of the Standard with the Modified Methylene Blue Reduction Technic. *J. Dairy Sci.*, 20:693–703, 1937.

28. Thornton, H. R. The Changing Methods for the Quantitative Estimation of Bacteria in Milk. *Canad. Pub. Health J.*, 29:270–276, 1938.

29. Warner, J. N. The Use of Resazurin in Determining the Bacterial Quality of Milk and Cream. *Dairy World*, 16:18–22, 54–56, 1938.

30. Wilson, G. S. The Bacteriological Grading of Milk. Medical Research Council (London) *Special Report Series, No. 206*, 1935.

31. Wright, William H., and Thornton, H. R. How Accurate Is the Quantitative Plate Count? *J. Bact.*, 13:63, 1927.

Experience of the Victorian Order of Nurses for Canada

With Cases of Pregnancy as Reflected by Case Records

J. T. PHAIR, M.B., D.P.H., F.A.P.H.A., A. HARDISTY SELLERS, M.D., D.P.H., AND MARY FERGUSON, R.N.

Chief Medical Officer of Health for Ontario; Medical Statistician, Department of Health for Ontario; and Supervisor, Victorian Order of Nurses for Canada, Toronto, Canada

FOR some years there has been considerable concern among both official and voluntary health agencies in the matter of the higher-than-should-be maternal death rate in the Dominion of Canada. This concern has been manifested in a variety of ways. The lay organizations have on occasion become restless under what they describe as the failure of those officially placed to evolve a satisfactory solution of this problem; with the result that they have attempted to draw their own conclusions from the limited amount of factual information which has been available in this country.

Invidious comparisons have been made as between Canada and those countries in which midwifery practice is the vogue and there is a pronounced inclination to place undue emphasis on the presumed significance of certain factors thought to be contributory to the high death rate.

The medical profession has been charged with an inadequate interest in the problem and it has been implied that such factors as unwarranted surgical interference, lack of adequate medical care, and the failure on the part of the profession to extend the maximum in the way of prenatal supervision have played a substantial part in bringing about this unjustifiable state of affairs. The necessity for the early establishment and continued maintenance of prenatal supervision has been emphasized to the extent that it is apparently regarded by many as a panacea for all the ills of the pregnant state.

The fact remains that the maternal death rate in Canada has been in the main unaffected by such efforts as have heretofore been directed at its lowering, and public concern in respect to this matter would appear to be justified.

Some 6 years ago, the Provincial Department of Health for the Province of Ontario sought the coöperation of the

* A preliminary report, read at a Joint Session of the Child Hygiene and Public Health Nursing Sections of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 28, 1938.

medical men of the province in an attempt to secure certain desired data in all cases in which death was associated with pregnancy. The supplying of this information was made obligatory by statute one year later. After a careful review of the data secured, it was felt that much might be gained by an attempt to secure specific information as to what happens to the 995 women out of every 1,000 who, following pregnancy, do not die. Actually, it was felt that little in the way of progress could be made until we were better informed as to conditions associated with what might be described as "normal" pregnancies.

The members of the Sub-Committee on Maternal Mortality of the Dominion Council of Health, appreciative of the difficulties of securing accurate information of this type, turned to the Victorian Order of Nurses for Canada, suggesting that an intimate statistical review of their records might be helpful. This organization, which is national in its scope, operates a highly desirable type of bedside nursing care in a large number of urban centers throughout Canada. Some 48 municipalities in the Province of Ontario alone are served by the Order and much of the service rendered is to those in need of nursing care during pregnancy. The average number of maternity cases annually attended by the Order during the last 5 years was roundly 12,000.

The committee was probably influenced in its decision to secure the help of the Order by the fact that for many years not only has the maternal mortality rate among those cases attended by the Order been approximately half that of the rate for the country as a whole, but also the neonatal rate has been uniformly lower than the official rate for the Dominion. The fact that these patients are largely cared for by physicians without any special qualifications in the field of obstetrical practice; that with relatively few exceptions they are delivered at home; and that many of them come from an economic level below the average; has continuously intrigued the interests of those officially concerned with this phase of organized public health.

The Order when approached was appreciative of the opportunity to make a contribution to the possible solution of this problem and willingly agreed to undertake much of the expense associated with the study. The study includes approximately 10,000 case records, comprising all cases attended by the Order during the years 1935 and 1936 in the Cities of Ottawa and Toronto as well as in East York and York Township. All cases were included regardless of the number of visits or whether the period of viability was attained or not. At this date, the information regarding 5,049 cases has been tabulated.

While it is planned ultimately to make available a complete detailed analysis of the results of the entire study, it has not been thought wise on this occasion to do more than report briefly our findings to date, under appropriate headings.

ECONOMIC STATUS OF THOSE SERVED

It was found that the majority of those receiving nursing care from the Order were, as previously implied, in the lower wage earning bracket. As the family income was not noted on the report form, this deduction was drawn from the fact that the monthly rental for living quarters was in 22 per cent between $10 and $15; and in 20 per cent between $16 and $24. Only about 1 per cent were reported as paying over $40 per month for housing accommodation.

This inference was further supported by the fact that the nurse, using a rather elastic measuring rod, reported the economic status as:

	Per cent
Comfortable	16
Supplied with the necessities of life	41
In a state of poverty	15
No reliable data reported	28

The home supplied less than one room per person in 35 per cent of the cases and 1 to 1.5 rooms per person in 30 per cent. The home conditions, a term with many implications, were noted by the nurse as being good in 53 per cent, fair in 23 per cent, and poor in 5.5 per cent.

SIZE OF FAMILY

In 16 per cent the cases were primipara; in 18 per cent there was one previously born child, while in 18 per cent the family consisted of 5 members.

SOURCE OF CONTACT

It is the fixed practice of the Order to serve only those who have already contacted their physician, although it is not required that the original contact with the Order shall be through the physician. In fact, only in some 19 per cent of the cases did the request for service come from the physician in attendance. In the bulk of the balance, namely, 52 per cent, the patient herself or her family sought the service. Only in some 5 per cent of the cases was the case referred by the existing public health agencies.

These findings do not necessarily imply an absence of interest in the matter of maternal hygiene by the health personnel in those municipalities under survey but rather that this field has been considered to be the rightful prerogative of the Order. It has been said that this concession of the responsibility of insuring adequate nursing supervision during the periods of pregnancy and labor for those less financially fortunate, and its attendant obligations in the field of maternal and child hygiene, to a semi-official agency, has on occasion been too willingly made. However, it is reasonable to presume that this criticism is unfounded and that the community public health nursing staff actually suggest, in many instances, that the contact be made by the family or physician instead of through official channels.

AGE

Five per cent of the cases were under 20 years of age; 24 per cent between 20 and 24 years; 27.5 per cent between 25 and 29; 21.5 per cent between 30 and 34; approximately 15 per cent between 35 and 39. These figures conform to the statistical data secured from other sources.

PERIOD WHEN CONTACT MADE

Much in the way of importance has been placed on the inadequacy of the prenatal supervision extended to those dying as the result of pregnancy. In the report of the Ontario study in 1934 [1] only 41 per cent were said to have received adequate prenatal care. The extent of the supervision in the present series can be inferred in part from the time in months when the patient contacted the Order.

In 24.7 per cent the contact was made before the end of the 6th month of pregnancy; 19.6 per cent were made during the 7th and 8th months; and 42 per cent occurred during the 9th month; with 31.6 per cent within 2 weeks of confinement; some 9.2 per cent were first seen during labor.

TIME OF CONTACT WITH PHYSICIAN

The time when the contact with the attending physician was made might also be considered as indicative of the extent of the supervision given. The time of the contact with the physician need not necessarily be coincident with the date of contact with the nurse, in view of the fact that, as previously mentioned, the contact with the doctor must come first.

Twenty-six per cent had already informed their physician of their condition before the beginning of the 4th month of pregnancy, and an additional 26 per cent had seen him before the end of the 6th month. Ten per cent made their initial contact during the 8th, and 6 per cent during the 9th month. Six per cent called him during labor. In 17 per cent, the time of contact was not recorded.

The extent of the medical supervision is unknown. It is, however, a reasonable implication that a significant part of the sustained supervision was left to the nurse following her contact with the patient.

TYPE OF NURSING SUPERVISION

The scope of this supervision was recorded as being either grade 1, 2, or 3, dependent on the time of contact in months, the number of visits made, and the periods elapsing between such visits. It was reported as grade 1 in 807 cases, grade 2 in 1,772, and grade 3 in 1,749. In 714 contact was too late to permit of grading.

PLACE OF DELIVERY

Delivery naturally took place in the home in the vast majority of those served, only 12 per cent being hospitalized. This latter group comprises not only those who were found to require hospital care during delivery but also those who requested the Order to supply only prenatal supervision, having originally planned to be cared for during labor in hospital. In no particular age group was hospital care more prevalent than in the other.

CONDITION ON DISCHARGE

Six weeks' post-natal care is extended; the patient being then ordinarily discharged. The condition of the mother at the time of discharge was noted as being: good in 94 per cent of cases and poor in only 33 cases.

COMPLICATIONS OF PREGNANCY

These were divided into medical and obstetrical, major and minor.

Medical—major: In this group, data were available in 4,261 cases. Heart disease was reported in 22 cases, pneumonia and influenza in the same number, nephritis in 16 instances, high blood pressure in 30, diseases of the thyroid in 5, mental disturbance in 13, others in this group number 32, giving a total of 141 cases, or 3.3 per cent in which some significant complicating illness was present during pregnancy.

Obstetrical—major: Early toxemia —65 cases, early hemorrhage in 85, pyelitis and cystitis in 14, late toxemia in 130, late hemorrhage in 56, late vomiting in 48, other complications 9, being a total of 375, or approximately 9 per cent in which some major obstetrical complication occurred (data for 4,276 cases).

Minor Medical and Obstetrical: Anemia of pregnancy—90 cases, dental caries 1,390 or 30 per cent, upper respiratory infection in 100 cases, phlebitis in 40, abnormal nipples 169, hemorrhoids 20, varicose veins severe enough to be persistently troublesome in 1,106, constipation in 11, and others 21, being a total of 2,363, or 56 per cent of the 4,263 cases in which such information was recorded.

COMPLICATIONS OF LABOR

Malpresentation was recorded in 60 cases, placenta previa in 8, dystocia in 21, and shock in 15, retained placenta in 2.

The following general complications of labor were noted in those delivered at home, *e.g.*, laceration in 792 cases, severe hemorrhage in 62, abnormal placenta in 20, laceration and hemorrhage in 19, and hemorrhage and abnormal placenta in 6 instances.

TYPE OF DELIVERY

Delivery was spontaneous in 75 per

cent of cases, was manual in 2.2 per cent, instrumental in 10.5 per cent, and operative in 0.3 per cent (no data in 11.7 per cent).

PUERPERAL PYREXIA

Pyrexia was defined as a temperature of 100.4 or over on two successive takings, or a single reading on two successive days. Forty-nine of these had a temperature of 100.4–101° in the first 5 days; 25 had such an elevation of temperature for from 6 to 21 days; while 19 had a temperature above 101° in the first 5 days, and 21 were above 101° for from 6 to 21 days.

OUTCOME OF PREGNANCY

Of the 5,059 cases included in this study, 109 aborted, 108 had a miscarriage; 4,681 gave birth to a living infant, and in 158 cases the infant was born dead. In 15 cases the mother died; only 11 of these, however, could be considered as true maternal deaths.

INFANT DEATHS

Those responsible for the conduct of the program of the Order point with pride to the fact that the neonatal death rate of the infants of those attended by the nursing staff is measurably lower than the general rate for the country as a whole. In the group under review, it was under 26.9 per 1,000 live births, in contrast to the provincial rate in Ontario of 32.4.

MATERNAL DEATH RATE

The maternal death rate in the group for the two years in question was 2.4 per 1,000 live births, in comparison with the Ontario rate of 5.3. Five of the 11 deaths occurred in the age group 20–29; 4 among those from 30 to 39, and 2 in the age group 40–49.

CONCLUSION

In conclusion, might we say that while a study of this type may appear to permit of little in the way of conclusion being drawn, we believe that when the statistical analysis is completed the available data will assist materially in placing in the proper sequence some of those factors known to contribute to the maternal morbidity rate, and presumably the mortality rate, and in so doing will be of some value to those who might rightly be concerned with the task of finding some answer to that disconcerting question why in those countries in which the highest percentage of pregnant women are cared for by a physician during the period of labor, is there no lessening in the hazards of child bearing?

REFERENCE

1. Phair and Sellers. A Study of Maternal Deaths in the Province of Ontario. *Canad. Pub. Health J.*, Dec., 1934.

A Health Department Birth Control Program*

ROY NORTON, M.D., M.P.H., F.A.P.H.A.

Assistant Director, Division of Preventive Medicine, North Carolina State Board of Health, Raleigh, N. C.

EIGHTEEN months ago the North Carolina State Board of Health became the first to sponsor a health department birth control program. The state has a total population of three and a half million people, over a million of whom are Negroes. Maternal mortality rates have been very high, as have also been the rates of birth and infant mortality. The data on infanticide and abortion are incomplete but competent observers estimate that these rates are too high.

Through a sympathetic attitude in medical and health matters the State Board's *Monthly Health Bulletin* has led the people to write letters presenting their problems and desires. In each of the last several years literally hundreds of underprivileged multiparous or organically diseased wives have written letters to the State Board of Health pleading for contraceptive advice—13 pregnancies and only 4 living children; 9 pregnancies in 11 years, and now suffering from heart trouble; 26 year old mother with 10th pregnancy and bedridden with cardio-renal disease; and so on. These women have begged for release from the health hazards to which they are exposed by contraceptive ignorance. They all desire children but they prefer that the babies come in such numbers and with the conception timed for the best health interest of mother and offspring. They want to be better mothers with healthier babies and they feel that being able to say when and under what conditions babies shall come will promote the attainment of these worthy aims.

Fortunately, North Carolina has passed no statutory hindrance to physicians who desire to give contraceptive advice to their patients, and federal statutes do not prevent this. Most physicians, however, have not been adequately taught in medical school regarding their legal rights and limitations, and many have, until recently, considered it illegal to give birth control information. To all except a favored few of their patients, therefore, they have turned a deaf ear to requests for such information. Physicians have been almost as afraid of giving contraceptive advice as they have been with regard to abortion and narcotics, fearing that they might get into legal difficulties on a technicality.

The state has been particularly fortunate in having liberal minded social

* Read before the Health Officers Section of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 28, 1938.

and religious leaders and in having liberal colleges. There has been no organized opposition to the growing liberalism and public interest in behalf of the underprivileged among our people.

DEVELOPMENT OF PROGRAM

Local leaders have given approval and coöperation to the work of the two birth control clinics that have been operated in the state for several years. The first began in 1922 and is still active. Both of these clinics have gradually gravitated into a closer connection with the local health department, although they began under private sponsorship. The work of those more liberal minded and better informed physicians who have given birth control information to certain of their fortunate private patients has also been given general approval.

The North Carolina Maternal Health League was organized in 1935 as an outgrowth from the North Carolina Social Service Conference which in 1932 led a large group of state organizations that have formally given approval to birth control work. For 25 years the Conference has enlisted the active sponsorship and full coöperation of a great many of the state's best leaders in practically all lines of activities. For many years these leaders were active in promoting a better medical and health education program for mothers, but no organized effort toward the establishment of birth control clinics was made either by the Conference or its successor League. For 15 years Dr. George M. Cooper, Assistant State Health Officer, has handled the health education work and edited the *Monthly Health Bulletin* of the State Board of Health. In this connection he has become familiar with the problems and desires of thousands of our people in the state who have written to the State Board of Health for information and help, and he has also been active in the Social Service Conference and the Maternal Health League work.

Early in 1937 a physician who was especially interested in seeing the public health value of the contraceptive program tested made an offer to the State Board of Health. This included the services for a year of demonstration work of a consultant nurse who had an excellent background of training and experience in organization work. The executive staff accepted this offer and the consultant was assigned to work in the Division of Preventive Medicine, of which Dr. Cooper is Director and in which the state maternal and infant health program is carried out. State Health Department sponsorship of local health department supervision of the giving of contraceptive advice for medical indications officially began April 1, 1937.

ORGANIZATION OF LOCAL PROGRAM

A letter was sent by the Assistant State Health Officer to the local health directors announcing the availability of medical and nursing consultant services for local health departments desiring assistance in the planning of programs for giving contraceptive advice for medical indications. About the same time a similar letter announcing these services was sent by the President of the Maternal Health League to the county welfare officers. The local health officers desiring these consultant services then made their requests to the State Board of Health. At the visit following such requests the nurse outlined the various local adaptations of a birth control program, the technics of birth control usually practised, the methods of selecting patients for the services, the cost of materials, the handling of patients and other similar problems. At this first consultation the health officer usually has arranged conferences between a few local medical and lay leaders and the consultant. If the

health officer then felt it advisable to try to organize a birth control service for his county or city the approval of the local medical society was requested. No request of the local health officer for medical society approval of the contraceptive program has been denied. Medical and nurse consultant services are then made available to those who are to be responsible for carrying out the birth control program of the health department.

OPERATION OF PROGRAM

It has been the policy to give contraceptive advice only to medically indigent mothers. Others are encouraged to go to their family physicians for proper advice. The method of selecting patients has varied according to local health department and medical society preferences. Referral has usually been by local physicians, the welfare department, or the health department medical and nursing staff. The patients have been served on strictly medical indications, and it has been found that these are sufficiently elastic to avoid the denial of service to those deserving it from the health department. In some health departments instruction is carried out altogether in clinics operated by the health officer or by local private physicians, in others the private physicians accept referral of patients for instruction and distribution of materials furnished through the health department, while in some others a large part or all of it is carried out through home visits by the public health nurses after investigation and approval by the health officer.

Considerable thought has been given to available contraceptive methods adaptable to a health department program. In most locations the sponge and foam powder technic has been the method of choice and only 5 clinics use an alternate method (diaphragm and jelly) in the health department work. The sponge and foam powder technic has the great advantage that materials can be distributed and adequate simple instructions given without requiring a large investment of a physician's time. Careful records are kept of all cases so that an accurate estimate of its effectiveness can be compiled. Even if it should eventually be proved that the effectiveness of the method selected is less than that of the more intricate methods, it is believed that it will make possible the reaching of a larger number of mothers and thus eliminate many undesirable pregnancies which could not be prevented in any other way.

The health department birth control program has in each case been coördinated with the general maternal and infant health program. The encouragement of having larger families in selected cases and even enabling some couples hitherto sterile to have babies has been as much a part of the program as has the assistance in the prevention of conception wherever medical considerations have justified it.

RESULTS

The sponsorship of local health department contraceptive programs has been carried on quietly. There has been no fanfare, ballyhoo, or over-aggressiveness. Following the announcement of the availability of the consultant service, the difficulty has been to meet the requests from the local health officers, and to begin even to scratch the surface of this great problem. There has been no hurry. Approval by local practitioners has been insisted upon by the State Health Department before inauguration of the program. After 18 months, 56 clinics are operating in 50 of the 100 counties in the state. No attempt has been made to make the service immediately available to great numbers. We have no imposing statistics to offer but, in the short time of operation and with the small number

of patients served, those familiar with conditions know that the medical need and the public desire justify the beginning of the program. Patients and others in the community have expressed appreciation for the services. A total of 1,141 patients have been served during the first 18 months. Though it is still too early to reach an accurate conclusion regarding the effectiveness of the method selected, we have found so far only 6 cases in which it apparently failed and the mentality of 3 of these was very low. Only a very small number (12 out of 1,141) have reported personal objections to the sponge and foam powder on account of unpleasantness, discomfort, irritation, burning or pain. Eventual closer follow-up will undoubtedly show more failures and more cases of irritation, partly at least because of the general low average intelligence, and poor personal hygiene facilities available to the group served.

An interesting by-product of this health department program has been the changed attitude of the local practising physicians in the communities served. The doctors have had their attention called to the availability of desirable contraceptives and to the fact that they may legally advise their use. As a result a great many women not in the indigent group have been given contraceptive advice by their family physicians.

COMMENT

1. The need and desire for a health department birth control program in the state has been observed and for 18 months an organized official attempt has been made to meet this urgent medical need and this public desire.

2. In the progress of the program during this brief trial it is felt that working quietly and ethically, selection of patients from among the medically indigent wives for strict medical indications and insistence upon local medical approval for state sponsorship have each proved helpful.

3. The sponge and foam powder or some comparably simple method seems particularly suitable for use by those being given this preventive maternal health service through health departments.

4. A health department birth control program is an essential part of the maternity and infant public health service and the better selection of pregnancy risks should favorably affect maternal and infant morbidity and mortality conditions in the counties served. To preserve balance in a generalized public health program it is important continually to develop more nearly complete health education programs and to make available the necessary clinical facilities that serve to encourage or prevent conception according to medical indications.

Late-Lactose Fermenting Organisms of the Coli-Aerogenes Group*

NEWELL R. ZIEGLER, M.D.

Department of Pathology, Bacteriology, and Preventive Medicine, University of Missouri, Columbia, Mo.

A NUMBER of investigators have reported the transformation of late-lactose fermenting organisms of the coli-aerogenes group to rapidly fermenting types by frequent sub-culture either in simple nutrient media or media containing lactose.[1-6] Such late-lactose fermenting organisms may belong to either the coli or aerogenes groups, as indicated by the Voges-Proskauer and methyl-red tests. Both indol negative and indol positive types are found. Such organisms have been isolated from the stools of both healthy people and of those ill with diarrhea, from a blood stream infection, and from water supplies. The acquisition of a normal rate of lactose fermentation appears to relate such organisms to the usual types of *B. coli* or *B. aerogenes*. Hershey and Bronfenbrenner,[6] however, suggested, on the basis of reversion of a rapid-lactose fermenting variant to a non-lactose fermenting strain in a sodium succinate medium, that late-lactose fermenting organisms may not be identical with other lactose fermenting members of the colon group. Similarly, Stokes, Weaver, and Scherago[7] reported the conversion of late-lactose fermenting organisms (paracoli) to rapid-lactose fermenters and back to late-fermenting types. They concluded that the strains studied were variants of various members of the coli-aerogenes group. It seems clear, then, as Kriebel and others have suggested, that such organisms are as definitely related to fecal contamination as *B. coli* itself.

One is interested in the conditions under which the late-lactose fermenting types may be found in water supplies. It is a common experience that such organisms come to our attention chiefly in water supplies which almost satisfy the Treasury Department's standard, or in highly diluted material. Lewis[2] has given us an important key which appears to explain the occurrence of late-lactose fermenting organisms in water. He studied the phenomenon of dissociation in mutabile strains of Escherichia and Aerobacter by the use of synthetic media containing lactose. These non-lactose fermenting variants gave rise to lactose fermenting strains in a proportion of 1:100,000 when grown on nutrient agar. He called attention to the fact that fermentation of lactose depends upon the relative proportion of fermenting and non-fermenting cells present. He found that when a mixture of cells of a strain of Aero-

* Read before the Laboratory Section of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 27, 1938.

bacter was prepared so that it contained 10 per cent of rapid-lactose fermenting cells and 90 per cent of non-lactose fermenting cells it fermented lactose in 12 hours irrespective of the total number of cells in the inoculum. With only 1 per cent of lactose fermenting cells present, the time required for fermentation was increased to 36 hours. Since the delay in lactose fermentation was found to be independent of the total number of cells of the two types in the inoculum, and since rapidly fermenting members of the coli-aerogenes group are commonly present in much greater numbers in a polluted water than the late-lactose fermenting organisms, late fermentation would not be evident in water analysis until some of the volumes of water inoculated contain only one organism. The slow-lactose fermenting organism is unable to grow as rapidly in competition with one capable of utilizing lactose rapidly.

The fact that organisms of the coli-aerogenes group can vary in their ability to ferment lactose and that slow fermenting organisms may be trained to ferment lactose rapidly appears to be well established by the work of Kriebel and others. Little has been offered to explain this variability to lactose fermentation. Hershey and Bronfenbrenner [6] and Deere, Dulaney, and Michelson [8] have demonstrated a decreased production of lactase by such slow-lactose fermenting variants.

Karström [9] has studied bacterial enzymes by a somewhat different technic in order to determine their function. He made use of cells grown on nutrient media to which various carbohydrates were added. These cells were washed, suspended in a suitable buffer solution in the presence of a specific sugar or alcohol, and the rate of acid production noted by titrating the acid produced at successive intervals. In this way he found certain differences in the kind and amount of enzymes produced. On the basis of this data he classified enzymes as constitutive and adaptive. The constitutive enzymes were always produced regardless of the substrate on which the cells were grown. Adaptive enzymes were only produced by cells when grown on a medium containing the corresponding substrate; *e.g., B. coli* grown in a medium containing lactose produces lactase, as indicated by the rapid production of acid when such cells are washed and placed in contact with lactose in a buffer solution. By using this method, Karström demonstrated that the enzyme lactase was an adaptive enzyme in the strains of *B. coli* and *B. aerogenes* which he studied. Such an enzyme may vary in amount, depending upon the conditions for growth or for synthesis of protoplasm. I suggest a reversal of such a mechanism is involved in the production of late-lactose fermenting types of organisms. In a polluted water the concentration of nutrient material is usually too low to permit active multiplication of cells but certain conditions may exist which may cause a decrease of lactose activity even in the absence of cell multiplication. Hitchner [4] reported the acquisition of rapid fermentation of melibiose at the same time as rapid fermentation of lactose was acquired by a slow-lactose fermenting strain.

Peterson,[10] in our laboratory, has tested an indol negative strain of late-lactose fermenting organism to determine whether or not its lactase was an adaptive enzyme as is true for *B. coli*. This strain was isolated from the intestinal tract of an infant ill with acute diarrhea.* In this organism lactose fermentation was produced by an adaptive enzyme. The lactase response in the presence of ammonium salts was much slower than for *B. coli* and *B.*

* Culture was obtained from Dr. E. R. Krumbiegel, Milwaukee Health Department.

aerogenes. This is additional evidence of the relationship of a late-lactose fermenting organism to members of the coli-aerogenes group.

One may consider the pathogenicity of late-lactose fermenting organisms in much the same way as one would consider the pathogenicity of *B. coli* or of strains of Aerobacter. Feldman [11] has reported a ratio of 5:4 for the occurrence of Escherichia-Aerobacter infections of the urinary tract. She regards the Aerobacter infections as being more toxic than those due to *B. coli*. The author [12] reported the occurrence of unusually high agglutinin titers in patients recovered from gastroenteritis when tested with a strain of late-lactose fermenting organism.

The following is a striking example of the pathogenicity of a strain of late-lactose fermenting organism obtained in pure culture from the blood of a previously healthy adult male. This patient had been well until March 11, 1937. On the morning of March 11 he did not feel well. He obsevred a slight diarrhea and was without any reserve energy. He went to work, but headache and dizziness developed and became so severe that he returned home about 11 o'clock. Although he ate a sandwich, he had no desire for food. He promptly became nauseated and vomited. He became extremely ill and shortly before 1 P.M. his physician was called. His pulse was weak; his blood pressure was systolic 50 millimeters; diastolic 30 millimeters. At times his pulse was not discernible. He was placed in an ambulance and taken to a hospital. He remembered leaving home but recalled nothing further until after he had been in the hospital for a time. A blood culture was taken. Lymphocytes appeared to be absent from the blood and hemoglobin was above normal. The blood culture became positive on March 13. This was plated and several colonies were isolated. All were Gram-negative, nonmotile, gelatin-negative, indol positive, methyl red positive and Voges Proskauer negative organisms, which fermented lactose only slightly in 5 days. Sucrose was not fermented. A stool specimen obtained on March 14 was plated on Endo's agar. The colonies which developed were almost all colorless and among these were many late-lactose fermenting organisms culturally identical with those isolated from the blood.

Blood was obtained for agglutination on the 3rd, 7th, and 18th days after onset. The first specimen of blood agglutinated the "homologous" organisms from the blood stream at a maximum titer of 1:50. The second specimen agglutinated this organism at a maximum titer of 1:100, and the third specimen agglutinated this organism at a maximum dilution of 1:500. A demonstration of a rising titer of agglutinins is now regarded as indicative of infection. In this case the isolation of the organism from the blood stream should leave little doubt as to the infectivity of this strain of late-lactose fermenting organism.

SUMMARY

1. Transformations of late-lactose fermenting organisms are discussed.

2. An explanation of the occurrence of late-lactose fermenting organisms in water supplies is suggested.

3. A mechanism for the production of late-lactose fermenting organisms is suggested.

4. The pathogenicity of a strain of late-lactose fermenting organism of the colon group is demonstrated.

REFERENCES

1. Kriebel, Ruth M. A Comparative Bacteriological Study of a Group of Non-lactose Fermenting Bacteria Isolated from Stools of Healthy Food Handlers. *J. Bact.*, 27:357–372 (Apr.), 1934.

2. Lewis, I. M. Bacterial Variation With Special Reference to Behavior of some Mutabile Strains of Colon Bacteria on Synthetic Media. *J. Bact.*, 28:619–638 (Dec.), 1934.

3. Dulaney, Anna Dean, and Michelson, I. D. *A.J.P.H.*, 25:1241, 1935.

4. Hitchner, E. R., Donagan, E. A., and Alpert, S. *J. Bact.*, 36:18 (Sept.), 1938.

5. Bronfenbrenner, J. J., and Davis, C. R. On

Methods of Isolation and Identification of the Members of the Colon-Typhoid Group of Bacteria. Late Fermentation of Lactose. *J. Med. Res.*, 39:33–37, 1918.

6. Hershey, A. D., and Bronfenbrenner, J. J. Dissociation and Lactase Activity in Slow Lactose-Fermenting Bacteria of Intestinal Origin. *J. Bact.*, 31:453–464 (May), 1936.

7. Stokes, J. L., Weaver, R. H., and Scherago, M. A Study of the Para-Coli Group. *J. Bact.*, 35:20 (Jan.), 1938.

8. Deere, C. J., Dulaney, A. D., and Michelson, I. D. *J. Bact.*, 31:625–633 (June), 1936.

9. Karstrôm, H. *Uber die Enzymbildung in Bakterien.* Dissertation, Helsingfors, 1930.

10. Peterson, O. H. Personal communication, 1938.

11. Feldman, Leah. Symposium on Late Lactose Fermenting Organisms. Presented at Annual Meeting of Society of American Bacteriologists, Dec., 1937.

12. Ziegler, N. R. Bacteriology of Epidemic Diarrhea. *A.J.P.H.*, 27:241–246 (Mar.), 1937.

Slow Lactose Fermenters in Water Analysis*

MAC HARVEY McCRADY, F.A.P.H.A.

Chief of Laboratories, Quebec Ministry of Health, Montreal, Can.

LATE in the spring of 1938, following a discussion by a few eastern laboratory workers on the advisability of including in the routine estimate of coliform organisms in water those coliforms isolated from primary lactose broth tubes containing only small amounts of gas, your referee was requested to determine, by means of a questionnaire, the trend of opinion on this question among laboratory workers in the United States and Canada. A questionnaire was accordingly prepared and submitted to about 30 laboratory workers who were presumed to be particularly interested in the subject.

QUESTIONNAIRE

Do you consider it advisable, in routine work, to include in the coliform estimate those coliforms confirmed from lactose broth presumptives in which there has been produced, after 48 hrs. incubation at 37° C.:

1. From unfinished or finished waters (coagulated, filtered, treated or filtered-treated, etc.):
   (a) Less than 5 per cent of gas .....
   (b) Less than 10 per cent of gas .....
2. From natural waters (unfiltered and untreated river, spring, well, lake supplies):
   (a) Less than 5 per cent of gas .....
   (b) Less than 10 per cent of gas .....

Twenty-five replies, the details of which are shown in Table I, were received.

It will be observed that 15 (Group 1) of the replies unqualifiedly favor inclusion, in the coliform estimate, of coliform organisms confirmed from every lactose broth tube containing gas, regardless of the amount.

A second group of 6 replies indicate that the laboratories concerned disregard certain lactose broth tubes containing small amounts of gas, because of their experience of failure to confirm the presence of coliform organisms from an extremely large proportion of such tubes. The implication is clear that were their experience of confirmation from tubes containing small amounts of gas more favorable, they would include the coliform organisms so confirmed in their coliform estimates.

One reply (Group 3) favors disregard of small amounts of gas only in those lactose broth tubes planted with natural waters.

Only 3 replies (Group 4) frankly express doubt of the sanitary significance of the slow lactose fermenters. One worker considers these organisms to be "attenuated" or "devitalized," to have little sanitary significance, and believes that they may safely be ignored. Another states that, in his experience, "When such slow lactose fermenters are found, even though they prove to be members of the coli-aerogenes group, the data so obtained usually fail to agree with the informa-

* Read before the Laboratory Section of the American Public Health Association at the Sixty-seventh Annual Meeting in Kansas City, Mo., October 27, 1938.

TABLE I

Summary of 25 Replies to the Questionnaire

		Favor Including Coliforms Producing, in Primary Lactose Broth, the Amounts of Gas Indicated				
		Treated Waters		*Natural Waters*		
Group	*Number of Replies in Group*	*5% Gas*	*10% Gas*	*5% Gas*	*10% Gas*	
1	15	+	+	+	+	
2	2	—	+	+	+	Reason given for negative replies in Group 2: Coliforms very rarely isolated. Springs & wells Lakes & rivers
	1	—	+	—	+	
	1	—	—	—	+	
	1	+	+	—	—	
	1	—	—	+	+	
				—	—	
	6					
3	1	+	+	—	—	
4	2	—	—	—	—	
	1	—	?	—	?	
	3					

tion given by the sanitary survey. In our opinion these organisms probably represent attenuated forms and are not indicative of such recent pollution as to be of significance." The third replies: "Our opinion . . . is based on the insistence of our Bureau of Sanitary Engineering that laboratory findings including such coliforms do not agree with field studies and throw considerable doubt upon the safety of supplies known to be in excellent sanitary condition."

A few excerpts from certain of the replies favoring the inclusion of slow lactose fermenters in the coliform estimate are quoted:

1. We know that a predominance of extraneous organisms from whatever cause may exert an influence ranging from partial suppression to complete elimination of the coliform group. For this reason it seems advisable not to miss any opportunity to recover the group organisms remaining viable. . . .

2. From the point of view of fresh feces those specimens which contain coliform organisms which give less than normal amounts of gas are less normal than specimens which give coliforms with orthodox gas production. I find that such forms do occur in fresh feces. Not usually in large numbers, it is true, but they do occur and occasionally in pure culture. In my work with long-stored feces, I have been impressed by the increase in the fecal suspensions of coliform organisms defective in their gas producing properties. It is my belief that in times of drought and in waters subject to stagnation this factor is of importance. . . .

3. If for certain classes of waters it is deemed advisable to give the results of the sanitary survey precedence over the bacteriological results in forming an opinion regarding the sanitary quality of a supply this might be done, but it should be accomplished in this manner and not by ignoring a predetermined section of the gas forming portions of the sample. Such a procedure of ignoring one section of the coliform organisms isolated (when we know that many factors other than attenuation diminish the amount of gas produced) would tend to nullify the science upon which the test is based. . . .

4. There is in my opinion no scientific reason for assuming that coliform organisms isolated from low percentage gas presumptives have any less sanitary significance than any other coliform isolations. . . .

5. We know little as to the cause of weak fermenters, whether it is due to attenuated strains weakened by purification processes or

if they are indicative of remote sources of pollution. It is conceivable that attenuated strains of coliform bacteria might become greatly rejuvenated under favorable conditions of environment. . . .

6. I think that quite often these traces of gas are of sanitary significance; for instance, we frequently run across a rather bad sample where the 1 c.c. or possibly the 0.1 c.c. portion may be typically positive, and yet one or more of the 10 c.c. portions may show less than 10 per cent of gas with all giving typically positive results on the partially confirmed test. . . .

7. We have good reason to believe that chlorination, storage, the presence of other organisms (particularly Pseudomonas) may delay or reduce gas production by typical strains of *E. coli*. Consequently, I feel that the amount of gas produced in primary lactose broth is not a very good indication of the presence or absence of significant members of the colon-aerogenes group. . . .

It is evident that the great majority of the laboratory workers replying to this questionnaire consider slow lactose fermentation to be of possible sanitary significance. Although the question submitted is not one that must necessarily be decided by a majority vote, the weight of experience represented by those who favor including these organisms in the coliform estimate is impressive.

DISCUSSION

The question of the sanitary significance of the presence in water of coli-like organisms that produce small amounts (5 c.c. or 10 c.c.) of gas in lactose broth, upon incubation at 37° C. for 48 hours, has long been the subject of occasional informal discussion by laboratory workers; but in general these slow lactose fermenters have been accepted as genuine members of the coliform group of indicator organisms. The present *Standard Methods of Water Analysis*,[1] for example, includes such organisms in the coliform group as therein defined.

Since it is the usual practice to leave to the control authority the appraisal of the sanitary significance of the presence in a water of *any* organism of the coliform group, difficulties arising from contradictory evidence furnished, on the one hand, by the laboratory and, on the other, by the field survey of the supply, are usually (although, unfortunately, not always) readily adjusted.

It is well known that coliform organisms frequently derive from sources unassociated with dangerous pollution, such as multiplication in sediments in mains, on wood, on other material of a vegetable nature, on tap washers, and from virgin soil, that such organisms are frequently atypical in character and that many of them are slow lactose fermenters. When, therefore, the cause of an excessive coliform density is determined to be other than that of access of pollution to the supply, the coliform report is simply ignored.

But is there reasonable justification for dismissing as of no sanitary significance *all* instances of slow lactose fermentation? One of the principal arguments favoring this course is that slow lactose fermentation is caused by "attenuated" organisms which have become so "devitalized" that they have lost their sanitary significance. This argument has been so frequently advanced that it deserves particular attention. In the first place, it perhaps will be admitted that the sanitary significance of the presence of coliform organisms in a treated, filtered, or filtered-treated water is ordinarily quite different from that of their presence in a natural water. Coliform organisms in a natural water serve usually as an indicator of the presence of human, animal, or soil pollution; and, depending upon the further indications furnished by the field survey of the supply, greater or less significance is attached to their presence. When a treated, filtered, or filtered-treated water is examined, however, since it is usually known that the original raw water

was polluted, the coliform estimate serves ordinarily, not as an index of pollution that may be more or less dangerous, but rather as a measure of the destruction or elimination, by the treatment, of associated disease organisms. Here there can be no question of tolerance—if the treatment is satisfactory, practically every disease organism of the raw water will have been eliminated and, by the same token, practically every coliform organism will have been eliminated. There exists no satisfactory evidence that slow lactose fermenters are more resistant to treatment than are typhoid or dysentery organisms; nor may it be contended that a treatment which reduces the gas production of a coliform organism 95 per cent necessarily deprives the typhoid bacillus of its pathogenicity. If, therefore, coliforms of *any* type persist in a treated water, and if their presence cannot satisfactorily be explained, the conclusion is inescapable that disease organisms may also persist in the water and that the treatment, therefore, has not been satisfactory.

Turning now to the question of the significance of slow lactose fermenters in natural waters, it must be admitted that the experienced water bacteriologist is inclined to regard the presence of these organisms with some measure of tolerance, not because they are so attenuated that associated disease organisms may be considered to be deprived of their pathogenicity, but because they are encountered with some frequency in relatively unpolluted soil, in sediments in mains, and on plants. On the other hand, it is well known that the presence of other organisms may reduce or even prevent the production of gas by coliform organisms in the lactose broth tube. In a recent study, in the Quebec laboratory, from 144 primary lactose broth tubes which contained only a bubble of gas after 48 hours of incubation, and which eventually yielded positive confirmations, coliforms that produced 5 per cent or more of gas in *secondary lactose* were isolated from 108, or 75 per cent. Rejuvenation of the organisms may have been responsible for some of this increase in gas production, but it must be remembered that the primary lactose broth is, itself, a rejuvenating medium.

Slow lactose fermenters have been shown by Parr [4] to occur in fresh feces, sometimes in pure culture. Since he finds that they occur occasionally during periods when the normal intestinal function is impaired, the presence in water of certain slow fermenters may be of more than ordinary sanitary significance. Parr [5] reports further an increase in the proportion of this type of coliform in feces that have been subjected to storage. It is evident therefore, that since the true slow lactose fermenters found in water may have derived from either fresh or stored feces, their presence, even in a natural water, cannot always be considered of no sanitary significance.*

CONCLUSIONS

Since the coliform density of a filtered, treated, or filtered-treated water is a measure of the effectiveness with which the treatment has eliminated disease organisms from the water, it is reasonable to attribute equal sanitary significance to the presence in such water of either typical or atypical coliform organisms, slow fermenters or rapid fermenters.

Slow lactose fermenters are found,

* In the above discussion, no reference has been made to such sources of error as inversion, during sterilization, of lactose to dextrose, and the presence in the broth of entrained air. These may readily be eliminated by exercising care when sterilizing lactose broth, and by incubating the tubes before use overnight, discarding those in which air bubbles are formed. Storage of fermentation-tubes at moderate, rather than very low temperatures may reduce the difficulty caused by entrained air.

although in small proportion, in fresh feces, in greater proportion in stored feces, and occasionally in discharges from cases of gastrointestinal disturbance; the presence of these organisms, even in *natural* waters, therefore, cannot always be dismissed as of negligible sanitary significance. Furthermore, since other organisms contained in the sample may reduce the amount of gas produced in lactose broth by typical coliform organisms, the volume of gas produced cannot be accepted as a sure indication of the type of organism present.

The replies to a questionnaire received from 25 laboratory workers of considerable experience of bacteriological water examination revealed that 15 of these workers favor unqualifiedly the inclusion of slow fermenters in the coliform estimate; 6 apparently favor including the slow fermenters, although in practice they do not attempt isolation from primary lactose broth tubes because in their experience coliform organisms are very rarely isolated from such tubes; 1 favors including the slow fermenters isolated from filtered and treated waters but not from natural waters; and only 3 frankly express doubt of the sanitary significance of the slow lactose fermenters.

It is evident, therefore, that the great majority of the laboratory workers are opposed to excluding slow lactose fermenters from the coliform group of organisms. In view of the various facts and arguments that may be adduced to support their position, it is suggested that, until sufficient evidence to the contrary is presented, water laboratories are well advised to include, in their routine coliform estimates, *all* coliform organisms confirmed from primary lactose broth.

REFERENCES

1. A.P.H.A. *Standard Methods of Water Analysis*, Eighth Edition, 1936.
2. *Pub. Health Rep.*, 29, 45 (Nov. 6), 1914.
3. *Pub. Health Rep.*, 40, 15 (Apr. 10), 1925.
4. Parr, L. W. The Occurrence and Succession of Coliform Organisms in Human Feces. *Am. J. Hyg.*, 27, 67 (Jan.), 1938.
5. Personal communication.

Slow Lactose Fermenters in Water Analysis*

ANNA DEAN DULANEY, PH.D., AND E. F. SMITH

Department of Bacteriology, University of Tennessee; City Laboratory of Memphis, Tenn.

IF sanitary importance is to be attached to the finding of slow lactose fermenting, coliform bacilli in water proof of either their close relationship to accepted fecal bacteria or of their etiological rôle in disease must be offered.

We have been interested in slow lactose fermenting and atypical organisms of this type since Dr. Michelson and I [1,2] isolated *B. coli* mutabile in high percentage from stools of very young babies suffering from an epidemic diarrhea during the winter of 1933–1934. These were the only bacteria consistently demonstrated in cultures from various sources—namely, feces, blood stream, pus from ears, and intestinal contents and heart blood at autopsy. We were very reluctant at the time to assign an etiological rôle to these organisms and we have never felt that the question as to whether they were the responsible agents of disease or whether they represented a marked alteration in the fecal flora as a result of physiological disbalance could be settled. Endo plates spread with fecal suspensions of these babies yielded 90 per cent or more of these organisms and this finding was obtained in 67 per cent of the affected babies.

At that time we also examined stools from normal babies and found the same type of organism in 12 per cent of cases—a finding which accentuated doubt regarding their ability to initiate disease. Since then, we have isolated this curious mutating organism only rarely from stools but we found that slow lactose fermenting and atypical coliforms are often present in the feces of normal and sick babies and adults. It has been our observation that such organisms are more numerous in stools from patients with diarrhea than in stools from normal individuals on stable diet.

In a series of 400 stools approximately 20 per cent were found to contain slow lactose fermenting organisms. We have usually found these organisms in small numbers, but in some specimens they have constituted from 10 to 50 per cent of all colonies. When colorless colonies from Endo's plates were transferred to Russell's Double Sugar agar, a paratyphoid reaction was obtained which was at times misleading. In most cases these slow lactose fermenting organisms have produced acid and gas in lactose broth after 2 to 5 days, though some strains required longer periods of incubation. Accelerated ability to ferment lactose usually followed their daily transplantation to this medium. Saccharose fermenting *Escherichia coli*, *Aerobacter aerogenes*, and intermediate

* Read before the Laboratory Section of the American Public Health Association at the Sixty-seventh Annual Meeting at Kansas City, Mo., October 27, 1938.

types have been identified. Intermediates have been found often enough to warrant them a place among the accepted fecal flora. We well realize that statistical data regarding the incidence of slow lactose fermenting or any other type organism found in feces, or the distribution of types means little, for we have obtained entirely different pictures on plates streaked with diluted fecal specimens from a single individual at different times.

The finding of slow lactose fermenting bacilli in feces has been reported by many workers. They have been regarded as the cause of diarrhea by some, evidence resting on their consistent presence in large numbers in feces of individuals affected. The variation which occurs from time to time in feces of individuals in normal health and on stable diet has been emphasized by Parr.[3] He uses the term "fecal-flora-crises" to designate the distortion or temporary elimination of the coli-intermediate group picture. The fact that such a crisis may occur in the feces of normal as well as in diseased individuals makes him doubt the etiological significance of such atypical bacilli. All must admit that the pathogenic properties of these atypical coliforms is very hard to prove. Even their demonstration in large numbers during disease does not rule out the possibility that they may be secondary in character.

Occasionally members of this group are isolated from sources where their etiological rôle cannot be questioned. During the past 3 years we have obtained 10 strains of slow lactose fermenting coliforms from sites other than the intestinal tract. Nine strains came from urine (cystoscopic specimens) and one from the spinal fluid of a child suffering from meningitis. All of these belonged to the Escherichia group.

We have found that approximately 50 per cent of the fecal specimens studied by us contained aerogenes organisms. In some specimens these organisms were absent or few, while in others they were the dominating type organism, and Endo's plates from other fecal samples showed only aerogenes colonies. There seems to be considerable variation in the reported incidence of aerogenes in feces (Brown and Skinner,[4] Tonney and Noble,[5] Breed and Norton,[6] Gray,[7] Parr [8]). The majority of fecal specimens studied by us have come from hospital wards which may have modified our findings. Aerogenes organisms are only occasionally pathogenic. We have isolated typical bacilli of this type from urine obtained by cystoscope and in one case we demonstrated this organism in 3 successive blood cultures from a patient suffering with a septicemia following a cholecystitis. In a recently studied diarrhea slow lactose fermenting aerogenes organisms were isolated in large numbers from feces at different times. No pathogen was demonstrated. Mucoid coli colonies (Theobald Smith[9]) are found on Endo's plates and it is often impossible to distinguish these from colonies formed by the aerogenes group. If mucoid colonies are fished at random, a good proportion of these will fail to grow in citrate and upon further study will be found to be *Escherichia coli*. These colonies are more frequent on Endo's plates incubated for longer than 24 hour periods.

Recently we became interested in the question of slow lactose fermenting bacilli which might be isolated from waters. We were primarily interested in the incidence and type of organism from such sources. For this study we used waters sent into the West Tennessee Division of the State Public Health Laboratory. Preliminary observations showed that slow lactose fermenters and atypical coliforms could be isolated from polluted and unpolluted waters. This is not a new observation—

Koser's [10] series of papers have included observations on such organisms found in water. Escherichia-Aerobacter intermediates have also been isolated from water by Lewis and Pittman,[11] Ruchhoft [12] and his associates, Gray,[7] Poe,[13] France,[14] Parr and Caldwell.[15]

The series of cultures to be described were all isolated from "negative" waters—waters examined according to the procedure recommended by *Standard Methods* and showing no gas in any of the lactose broth tubes after the usual 48 hour incubation period. A pooled sample from several tubes was diluted and spread on dry Endo's plates. Colorless or colored colonies suggestive of the coliform group of organisms were fished to lactose broth. When fermentation of the lactose broth occurred these cultures were inoculated to Endo's plates and colonies fished to Russell's Double Sugar agar. This culture was subjected to two or three subsequent platings and the final Russell's Double Sugar Agar culture used for inoculation of various media.

These waters (300 in number) came from various sources. Private and semi-private wells in Memphis and public and private wells in Western Tennessee were represented. Three samples were from swimming pools and these were the only treated waters studied. All samples had been collected by trained persons. The interval between the time of collection and inoculation of lactose broth varied from a few hours to 24 hours. The samples from local wells reached the laboratory in an hour or so—those from out of town were usually sent in by special delivery and were not in transit over 24 hours. All specimens were un-iced.

Thirty-nine, or 13 per cent, of the 300 waters contained slow lactose fermenting organisms, "slow lactose fermenting" in that the initial 48 hour growth in lactose broth did not indicate their presence. Approximately 100 strains were isolated but when several of these from one water were of the same type, only one was counted. In most cases the colonies on Endo's plates were abundant, thus suggesting that the organisms had originally been present in the water in fair numbers. These organisms were Gram-negative non-sporulating bacteria producing acid and gas in lactose broth in 1 to 5 days after reinoculation from Endo's agar. Three strains required periods longer than 5 days. Small amounts of gas were usually produced in lactose broth. In most cases a paratyphoid reaction was given on Russell's Double Sugar but in a few instances the reactions were typical of coli.

The distribution included 18 members of the aerogenes-cloacae group as judged by lack of indol formation, negative methyl-red, positive Voges-Proskauer reactions, and abundant growth in citrate medium (made according to Koser's formula). Of these organisms, 3 liquefied gelatin. These may have been degraded aerogenes (Parr [3]) or cloacae types. All fermented cellobiose and were uric acid positive. Two strains were atypical in that indol was formed.

There were 19 methyl-red positive and Voges-Proskauer negative strains, of which 4 formed indol and grew in citrate medium. Fifteen cultures were indol negative and of these 12 were citrate positive and 3 citrate negative. All but one (an indol negative strain) produced acid and gas in cellobiose. This latter group of organisms would be classed as colon-aerogenes intermediates. No typical coli organisms were isolated. We are inclined to regard the intermediates which were indol negative, methyl-red positive, Voges-Proskauer negative and citrate positive as belonging to the aerobacter group while the strains which were indol positive, methyl-red positive, Voges-Proskauer negative and citrate positive

would seem to be more closely related to *Escherichia coli*.

No correlation between the source and finding could be established.

The question arises—do such data have any sanitary significance, or are they to be classed as merely interesting and yielding further information regarding the wide distribution of slow lactose fermenting coliform organisms?

As is well known, these atypical organisms may often complicate the confirmatory phase of water examination. An example is offered by one water on our list which is from a series examined monthly. Several times during the past year some of the lactose broth cultures have shown small amounts of gas, and atypical coliform organisms were demonstrated on Endo's plates and in lactose broth subsequently inoculated. Most tests were satisfactory but from these "negative" cultures we isolated the same or closely related organisms. Various factors—seasonal, quantitative, dissociative—may explain the detection of these organisms by routine methods at times, and the failure of detection at other times. Failure of detection by routine methods by no means indicates that they are not present.

Recently, water-borne epidemics of gastroenteritis have been reported which stimulate interest in the question of their potential pathogenicity (Veldee,[16] Ziegler,[17] Pharris, Kittrell, and Williams [18]). Ziegler [16] isolated cultures from feces of patients during one of the epidemic periods which were identical in cultural reactions with those found in the city water supply at a time when typical *B. coli* were not demonstrated.

We have no history that any of the waters used in this preliminary study was ever suspected of causing an outbreak of gastroenteritis. Assuming that such occurred, how much significance could be attached to the presence of these organisms—even in large numbers—in the absence of fecal coli? One of two admissions must be made—they indicate fecal pollution, sufficiently recent to be significant, or, these organisms are alone capable of producing disease.

How may we determine the fecal or non-fecal nature of these organisms by procedures available in the usual laboratory? What is to be our criterion of pathogenicity?

The majority of these coliforms are intermediates. We have isolated organisms from feces which give identical cultural reactions, but shall we consider them truly fecal bacteria? Carpenter and Fulton [19] found that 13.3 per cent of coliforms isolated from human feces fell into the intermediate group and they conclude that they have sanitary importance. A table in a recent paper by Parr [20] indicates that 7.7 per cent of fresh fecal specimens contained these organisms and that this incidence was increased upon storage. His table shows that over half of the intermediates encountered in fresh feces and approximately one-third of those in stored feces were indol negative, methyl-red positive, Voges-Proskauer negative, and citrate positive. It is interesting that 12 of the 39 slow lactose fermenting strains isolated from water fell into this group.

The origin of these intermediate organisms presents an intriguing question. Are they variants—stable or unstable—of better recognized forms? In our laboratory, Michelson [2] has found that citrate using strains may arise from non-citrate using *B. coli* mutabile. When these organisms were subjected to prolonged growth in lithium chloride broth and later spread on Endo's plates, some colonies formed mucoid papillae which yielded aerogenes-like organisms as regards their methyl-red, Voges-Proskauer and citrate reactions. He was not able to produce this phenomenon with orthodox *Escherichia coli*.

In conclusion, we feel that we must recognize the widespread distribution of such coliform organisms in untreated waters and in waters of apparently satisfactory sanitary state. They may or may not be detected in routine examinations. This finding should invite caution as to interpretation of their presence at any time. The results from sanitary surveys should be carefully applied and such data correlated with bacteriological findings. At the same time we must recognize that their non-fecal origin has not yet been proved and all information regarding their potential pathogenicity should be carefully accumulated and evaluated.

REFERENCES

1. Dulaney, Anna Dean, and Michelson, I. D. A Study of *B. coli* mutabile from an Outbreak of Diarrhea in the New-born. *A.J.P.H.*, 25, 11:1241 (Nov.), 1935.

2. Michelson, I. D., and Dulaney, Anna Dean. Comparative Study of *B. coli* mutabile from an Outbreak of Diarrhea in the New-born. *South. Med. J.*, 29:611 (June), 1936.

3. Parr, Leland W. Sanitary Significance of the Succession of Coli-aerogenes Organisms in Fresh and in Stored Feces. *A.J.P.H.*, 26, 1:39 (Jan.), 1936.

4. Brown, J. W., and Skinner, C. E. Is the Eijkman Test an Aid in the Detection of Fecal Pollution of Water? *J. Bact.*, 20:139 (Aug.), 1930.

5. Tonney, Fred O., and Noble, Ralph E. The Direct Count of Colon-aerogenes Organisms. *J. Infect. Dis.*, 48, 413 (Apr.), 1931.

6. Breed, Robert S., and Norton, John F. Nomenclature for the Colon Group. *A.J.P.H.*, 27, 6:560 (June), 1937.

7. Gray, J. D. Allan. The Significance of Bacterium Aerogenes in Water. *J. Hyg.*, 32:132 (Jan.), 1932.

8. Parr, Leland W. Organisms Involved in the Pollution of Water from Long Stored Feces. *A.J.P.H.*, 28:445 (Apr.), 1938.

9. Smith, Theobald. Notes on Bacillus Coli Communis and Related Forms. *Am. J. Med. Sci.*, 110:283 (Sept.), 1895.

10. Koser, Stewart A. Sanitary Significance of Differential Tests for the Coli-aerogenes Group. *A.J.P.H.*, 17, 11:1178 (Nov.), 1927.

11. Lewis, I. M., and Pittman, E. E. Quoted by Carpenter and Fulton. *A.J.P.H.*, 27, 8:822 (Aug.), 1937.

12. Ruchhoft, C. C., Kallas, J. G., Chinn, Ben., and Coulter, E. W. Coli-aerogenes Differentiation in Water Analysis. *J. Bact.*, 22:125 (June), 1931.

13. Poe, C. F. Quoted by Carpenter and Fulton. *A.J.P.H.*, 27, 8:822 (Aug.), 1937.

14. France, R. L. Studies of Bacterium Coli in Privately Owned Rural Water Supplies. *J. Bact.*, 25:623 (June), 1933.

15. Parr, L. W., and Caldwell, E. L. Variation within the Colon-aerogenes Group as Found in Bacteriologic Analysis of Water from Contaminated Pumps. *J. Infect. Dis.*, 53:24 (July-Aug.), 1933.

16. Veldee, M. V. An Epidemiological Study of Suspected Water-borne Gastroenteritis. *A.J.P.H.*, 21, 11:1227 (Nov.), 1931.

17. Ziegler, Newell R. Bacteriology of Epidemic Diarrhea. *A.J.P.H.*, 28, 3:241 (Mar.), 1937.

18. Pharris, Crit. Kittrell, F. W., and Williams, W. C. A Water-borne Outbreak of Gastroenteritis in a Tennessee Town. *A.J.P.H.*, 28, 6:736 (June), 1938.

19. Carpenter, Philip, and Fulton, MacDonald. Escherichia-aerobacter Intermediates from Human Feces. *A.J.P.H.*, 27, 8:822 (Aug.), 1937.

20. Parr, Leland W. Coliform Intermediates in Human Feces. *J. Bact.*, 36, 1 (July), 1938.

Vol. 29

American Journal of Public Health
and THE NATION'S HEALTH

Official Monthly Publication of the American Public Health Association

Volume 29 March, 1939 Number 3

MAZYCK P. RAVENEL, M.D., *Editor* AUGUSTA JAY, *Editorial Associate*
REGINALD M. ATWATER, M.D., *Managing Editor*

Editorial Board
THE MANAGING EDITOR, *Chairman*
PROF. IRA V. HISCOCK
KENNETH F. MAXCY, M.D.
ARTHUR P. MILLER, C.E.
HARRY S. MUSTARD, M.D.

ARMY MEDICAL LIBRARY NEEDS NEW BUILDING

SOMEWHAT apart from the row of magnificent new government offices in the nation's capital stands a rather decrepit old red brick building. To its dingy halls come the world's foremost medical scholars. They come to consult and examine medico-literary treasures that can be found nowhere else. They come to delve into the history and tradition of medicine, to search for valuable information that will contribute to human welfare. And in seeking and finding this material, they gain not merely knowledge, but inspiration.

In this venerable structure, erected in 1887, is housed the Army Medical Library and Museum. Here is the largest collection of medical books in existence, nearly a million volumes. Here are 450 of the only 600 known medical incunabula, including more first editions than in any other library. Here are ancient documents, one dating from 1467, and numerous rare manuscripts of inestimable value.

This priceless collection of medical literature deserves better quarters. So inadequate is the present building that many books must be stored in the basement. Manuscripts, records, and books that are irreplaceable are exposed to the danger of fire and the hazards of dust, dirt, and decay.

In 1919 a site for a new building for this notable library and museum was acquired on the grounds of the Army Medical Center in Washington. Despite numerous requests and recommendations, Congress has never seen fit to make the necessary appropriation for a suitable edifice. At the last session of Congress, a building costing $3,750,000 was authorized, but no funds were actually appropriated for the purpose.

This relatively modest appropriation must be made by the present Congress. When the War Department has requested the funds, if it has not already done so, every physician and sanitarian should actively support this important measure.

The Army Medical Library and its indispensable *Index* were once characterized by the late Dr. William H. Welch as America's greatest contribution to medical science. Although established in 1836, the development of this library and of its outstanding services were due largely to the genius of Dr. John Shaw

Billings, one of the founders and early presidents of the American Public Health Association.

This Association urges, therefore, favorable consideration by Congress of an adequate appropriation for the world's foremost library devoted to medicine and public health, in order that this leading scientific institution may be provided with proper facilities for its invaluable collection of medical literature, and also so that it may serve physicians, scientists, and public health workers even more efficiently than in the past.

REFERENCE

A.J.P.H., 26:930 (Sept.), 1936.

HENRY F. VAUGHAN, DR.P.H.—AN APPRECIATION

IT is seldom that a health officer is more signally honored than was Dr. Henry F. Vaughan of Detroit at the testimonial dinner on January 12, under the auspices of the Detroit Department of Health. Dr. Vaughan has completed twenty-five years of service in the Department, first as an employee of the Division of Sanitation and, since 1918, as Commissioner of Health.

The group which participated in this recognition was significant, not only because of its size—1,050 people were assembled in the Masonic Temple for dinner—but because of the great variety of local individuals and organizations which were represented as a testimonial to the leadership of Dr. Vaughan during his quarter century of service. An illuminated chart comparing the death rates in Detroit in 1913 and 1938 was eloquent testimony to the changes which have taken place in this industrial center where for two decades and more the profession has become accustomed to look for a superlative example of public health administration. Those in attendance could not fail to note the generous credit which Dr. Vaughan gave to his colleagues for the advances which Detroit has made in its health program. It was a subtle revelation of the underlying reason for Dr. Vaughan's undisputed leadership.

Some health officers seem strangely reluctant to allow demonstrations of public approval of their services. Of course it is quite conceivable that these exhibitions might run beyond the limits of proper professional ethics; yet when a public expression is so sincere and spontaneous as was the case in Detroit, it must be conceded that it does a community good to recognize the devoted public service of all such soldiers of the common good. The Association joins with Detroit in congratulating Dr. Vaughan and his distinguished staff.

EQUINE ENCEPHALITIS IN MAN

ONE of the most interesting as well as important medical events in 1938 was the outbreak of equine encephalitis in several parts of the country, notably in New England. In Minnesota an epidemic in horses began in 1934 and the disease was very prevalent in 1937. In New England the outbreak began in Massachusetts in August, 1938. Important as this disease has been from the economic standpoint, the great interest which attaches to it is due to the fact that for the first time there was clear proof of its transmission to man. At the meeting of this Association in Kansas City a paper was read by Dr. Feemster,[1]

who gave the details of 8 of these cases and discussed the situation fairly completely. As he said, these 8 cases in Massachusetts, are the first human infections definitely proved to be due to the equine virus. "An entirely new public health problem has been opened up and the equine disease assumes an added importance."

Shortly afterward two papers appeared in a single issue of the *J.A.M.A.*,[2, 3] one reporting 6 cases of human encephalitis which occurred in September, 1937, all in farmers, 5 of whom had been in contact with sick horses. The blood serum of 3 of these patients neutralized the Western strain of equine encephalitis. The authors state that as far as known this was the first time that neutralization of the equine virus by human serum had been found. Both of these papers discussed at some length the agency of insects, especially varieties of mosquitoes, in spreading the disease among horses, some observations concerning which had been made as far back as 1933.

Now we have a report from the Harvard Medical School[4] on the occurrence of equine encephalomyelitis in ring-necked pheasants on range. The authors suggest that the horse plays only a minor part in the spread of equine encephalomyelitis and that the chief agents in its dissemination are migratory birds. They are inclined to the belief that the term "equine" is misleading as the disease is probably an avian infection, and doubt whether the horse or other domestic animals play any essential part in the perpetuation of this disease. "It may be only under accidental circumstances or when the infection arises to a certain level that it overflows and becomes a serious problem as regards the horse and even the human being."

In his address at Kansas City, Feemster told of the isolation by Fothergill and Dingle of the Eastern type of virus from a pigeon taken from an area in which the horse disease had been prevalent and where these birds had been dying in unusual numbers during the summer of 1937. This observation has now been published in full.[5] All of the mice injected intracerebrally with both the filtered and unfiltered material died in 48–96 hours with symptoms similar to those of mice infected with equine virus of the Eastern variety. The identification of the pigeon virus was determined by the intracerebral injections of guinea pigs which had been immunized against the Eastern and Western varieties of the virus, and in normal controls.

The writers concluded that this work proved that the virus from this pigeon was that of the Eastern variety of equine encephalomyelitis, the disease having been "spontaneously contracted in an area where equine encephalomyelitis was prevalent among horses." The susceptibility of pigeons was demonstrated as early as 1933 by Giltner and Shahan,[6] and in 1935 Ten Broeck, Hurst, and Traub[7] suggested that pigeons might be the host reservoirs of this virus. A number of other observers in this country and in Europe have shown the susceptibility of various birls to the equine virus, including ducks, geese, hawks, black birds, and some others.

That there was a wide field open for study goes without saying. A very recent report[8] is that epidemics of encephalomyelitis have broken out in the northern part of South America. Material has been sent to the Lederle Laboratories where experiments are now going on. The symptoms of the disease resemble those from the eastern outbreaks of the United States, but it is certain that the virus is significantly different from either of the two known American strains. The Venezuelan strain is immunologically different from either the Eastern or

Western Forms which we know here, but a remote relationship is suggested between the Eastern and Venezuelan strains.

REFERENCES

1. Feemster, Roy F. Outbreak of Encephalitis in Man Due to the Eastern Virus of Equine Encephalomyelitis. *A.J.P.H.*, Dec., 1938, p. 1403.
2. Eklund, C. M., and Blumstein, Alex. The Relation of Human Encephalitis to Encephalomyelitis in Horses. *J.A.M.A.*, Nov. 5, 1938, p. 1734.
3. Wesselhoeft, Conrad, Smith, Edward C., and Branch, Charles F. Human Encephalitis. Eight Fatal Cases, with Four Due to the Virus of Equine Encephalomyelitis. *J.A.M.A.*, Nov. 5, 1938, p. 1735.
4. Tyzzer, E. E., Sellards, A. W., and Bennett, B. L. The Occurrence in Nature of "Equine Encephalomyelitis" in the Ring-necked Pheasant. *Science*, Nov. 25, 1938, p. 505.
5. Fothergill, L. D., and Dingle, John H. A Fatal Disease of Pigeons Caused by the Virus of the Eastern Variety of Equine Encephalomyelitis. *Science*, Dec. 9, 1938, p. 549.
6. Giltner, L. T., and Shahan, M. S. *Science*, 78:63, 1933.
7. Ten Broeck, C., Hurst, E. W., and Traub, E. *J. Exper. Med.*, 62:677, 1935.
8. Beck, C. E., and Wyckoff, Ralph W. G. Venezuelan Equine Encephalomyelitis. *Science*, Dec. 2, 1938, p. 530.

GROWING PAINS

IT is an interesting coincidence that two extensive studies of so-called "growing pains," * one in England [1] and one in America, should have been published almost simultaneously. Hawksley,[1] though regarding the name "growing pains" as very unsatisfactory, has found that "In spite of the challenging name of this condition it is thus perhaps the most suitable as, evading all concrete questions of aetiology, it describes a condition which is common in the growing human being." For a long time it has been taught almost universally that growing pains were an indication of rheumatism and that children suffering from them were in danger of development of cardiac lesions.

In a discussion before the American Rheumatism Association, Shapiro,[2] of Minneapolis, made the statement that, in from 8 to 50 per cent of children considered as rheumatic, the condition has been diagnosed on the basis of pain in the extremities alone. At the Lymanhurst Health Center an analysis of the histories of 100 patients with well developed rheumatic heart disease showed that 84 per cent had a definite history of a major attack of rheumatism—either rheumatic fever, or chorea, or both. Of the remaining 16, in practically every instance while there was no history of a major attack of rheumatic infection there was definite evidence of a long continued rheumatic infection.

At the same clinic a follow-up study, continued for 3 years on 200 children who complained only of leg pains, failed to show evidence of chronic rheumatic infection. They are in general good health and none of them have developed chronic heart disease.

T. Duckett Jones, of Boston, in discussing these findings, said, "the so-called growing pains in a child, without a frank history of previous rheumatic fever, do not frequently occur with other manifestations of rheumatic fever or a tendency to develop subsequent rheumatic heart disease. . . . The insidious or asymptomatic development of rheumatic heart disease in children is uncommon but in the young adult it is observed. . . . Mild to severe acute illness is almost invariable, and vague syndromes rarely exist."

Nazum, speaking of how prevalent the belief was that growing pains in children meant rheumatic fever, said that 3 of 6 current medical textbooks he

* Seham and Hilbert attribute the use of the term "growing pains" to Duchamp about 100 years ago. *Am. J. Dis. Child.*, 46:826, 1933.

examined laid stress on the importance of the history of growing pains in arriving at a diagnosis of rheumatic fever. In real rheumatic infections, approximately 75 per cent of children develop clinical evidence of heart lesions, and it is generally believed that every child with rheumatic fever suffers some damage to the heart, about 75 per cent of them having such a degree of inflammation as to produce real damage to the valves or the heart muscle, or to both.

In England (1936) Sheldon [1] analyzed 189 cases of growing pains in the Great Ormond Street Hospital and, after following up for 4 years, found only two who had developed rheumatism with heart lesions and none of them showed chorea. He pointed out that there was no evidence of the histo-pathological changes characteristic of acute rheumatism in growing pains, and that there is no relation between growing pains and sore throats.

In a further series of 24 cases of growing pains followed by Sheldon for 18 to 36 months none developed rheumatic manifestations, making a total of 213 cases of growing pains carefully followed, in which carditis developed in less than 1 per cent.

Of 1,000 children in London and Birmingham seen over 10 years, all those with a history of growing pains were especially studied, and at the Great Ormond Street Hospital, 115 cases of growing pains were subjected to special examinations and 64 of them were followed up after a lapse of 4 years. These children gave a variety of symptoms which are more or less characteristic of such cases, but none of them have shown any evidence of cardiac rheumatism. Taking the cases followed by Sheldon for 4 years with these 64 we have a total of 253 children, only 2 of whom, or less than 0.8 per cent, have developed rheumatic carditis.

The conclusions from these two studies, one in England and one of this country, are that the syndrome of growing pain is not related to rheumatic fever or sub-acute rheumatism and does not provoke rheumatic carditis.

An interesting discussion developed in this study—Does growth of itself produce pain? Shapiro states that he has consulted a number of investigators who are interested particularly in the study of growth, and tried to find out whether or not normal growth in itself might produce such symptoms as are known as growing pains.

No one would commit himself. There are suggestions, however, growing out of the examination of the 115 children mentioned. "There is a frequent history of colds and coughs, vasomotor instability, signs of vague ill health, such as lack of increase in weight, which of itself shows that the pain is not caused by growth. The most common cause was found to be minor orthopedic deformities. Psychological maladjustment was common and "many cases suffered from over-anxious parents, unkind relatives, or unsatisfactory relations with teachers or colleagues at school."

No doubt the result of these studies will be a relief not only to many physicians but also to parents, but they emphasize the importance of careful diagnosis.

REFERENCES

1. *J.A.M.A.*, Nov. 19, 1938, p. 1960.
2. *J. Roy. Inst. Pub. Health & Hyg.*, Oct., 1938, p. 798.

PUBLIC HEALTH EDUCATION*

A Health Best Seller—Nearly 2 full columns in the *New York Times* (Dec. 18, 1938), appeared under these headlines:

> Little Book on "Infant Care" Is Government's "Best Seller." Starting out in 1914, Its Various Editions Have Had a Circulation of 11,000,000 and It Has Gone All Over the World.

The article announced a revised edition of a little paper-bound book which "has made its mark in the world because of its distinguished rating among the best volumes on this subject" of infant care.

The author writes interestingly about "Infant Care" and "Pre-natal Care," second best seller, how both pamphlets were written, and how they have been distributed and used. Single copies have been loaned widely, and numerous typewritten copies have been made when it was not understood that the government sold them for only 10 cents each.

They Who Know Want to Know More—That the knowingest people are eager learners was brought out in *The Reporter*, 407 7th Ave., New York, N. Y., Sept., 1939. One of the keenest writers on commercial advertising says there:

> Direct mail advertising conventions have been going on for 20 years, and every one that I have ever attended turned out to be an opportunity to learn a lot, no matter how much you knew already.
>
> Maybe it's a fact that people who already know a lot about anything are always eager to learn more. Or maybe it is because you have to know something in order to know how little you know. I've heard both reasons given.

Possibly a Wrong Approach—Famed "Typhoid Mary," in dying not long ago, rendered service to health education. Her death was seized by alert editorial writers to point a health moral. (We wonder how many alert health educators seized the opportunity by submitting the facts to their local or state editorial writers.) *Baltimore Health News* (Jan., 1939) did a good follow-up. Under "Wrong Career" the *News* reprinted the masthead of the *Baltimore Sun* and its editorial on Mary. The *Sun* made an interesting point which may have further application.

Here is part of the editorial:

> Perhaps if Mary Mallon had been approached in the right manner, her pride as a cook could have been directed into a legitimate pride as a typhoid carrier. After all, she was the first recognized carrier of the disease, and she provided the medical profession with a useful living model for the study of typhoid distribution and the means to check it. She might have become more coöperative if it had been made plain to her that she was no common carrier of typhoid, but a very distinguished one.

FOR EDUCATION AND STUDY

The first item below tells of something to pass on to the League of Women Voters—that is, after the staff has read it. The second item is for any group concerned with baby welfare.

If any one doubts the utility of sending letters to legislators, he should read "Write Your Congressman Immediately!" by Dwight Anderson, long connected with the National Tubercu-

* Please address questions, samples of printed matter, criticism of anything which appears herein, etc., to Evart G. Routzahn, 130 East 22d St., New York, N. Y.

losis Association. Mr. Anderson reports on replies to questions sent to senators, representatives, and New York State legislators. Reprinted from *Public Opinion Quarterly*. Ask Medical Society of State of New York, 2 E. 103rd St., New York, N. Y. *Free.*

"Baby's Daily Time Cards" is a group of 7 cards, 5 by 8 inches, hole at the top, with a knotted cord and the suggestion: "Hang this where you can see it every day." One side of card carries a time table, the other, "Training the Baby," with a card for first 4 months, 5th and 6th months, and so on. At foot of each card is reference to a Children's Bureau publication for further information. Single sets *free* from Children's Bureau, Washington, D. C.

A pay envelope series of folders which ought to get read is put out by Tuberculosis and Health Society, 911 Locust St., St. Louis, Mo. Every month, 30,000 copies of a new folder are distributed through industrial and mercantile establishments (sent only upon request to firms willing to distribute them) and to the Society's library racks in branch libraries, hospital dispensaries, etc. The folders are 2¾ by 5 inches, 4 pages on stiff paper (so much better than the flimsy paper sometimes used), limited text and pictures, with modernistic cover which has attention value on a small scale job. The titles:

Don't Take a Chance . . . It Starts by Contact . . . When the Stoplight Signals . . . A Century of Progress . . . and so on.

"Early is the Watchword in Cancer Control" (1 page leaflet); "On the Cancer Front with the Field Army" (folder). Both illustrated. American Society for Control of Cancer, 1250 Sixth Ave., New York, N. Y.

If you wish to look into the possibility that colors may be useful in public health work, see "Color—Our New Star Salesman," by McQueeny and Podolsky. *Rotarian,* 35 E. Wacker Dr., Chicago, Ill. Jan., 1939. *25 cents.* Leads as to color values in printed matter, offices, clinics, equipment, etc., and a reading list.

"Diets of Families of Employed Wage Earners and Clerical Workers in Cities," by H. R. Stiebeling and E. F. Phipard, Bureau of Home Economics, Dept. of Agriculture, Supt. of Documents, Washington, D. C. 140 pp. *15 cents.* "What typical American city families are eating and how their diets measure up against nutrition standards." Worth bringing to attention of various groups.

"Social Hygiene: Free and Inexpensive Materials." *American Journal of Nursing,* 50 West 50th St., New York, N. Y. Feb., 1939. *35 cents.*

Public Health Nursing, 50 West 50th St., New York, N. Y. (reprints):

The Serum Treatment of Pneumonia, by Rogers and MacChesney (*25 cents*) . . . Cerebral Palsy, by W. M. Phelps (*20 cents*) . . . "What's Done We Partly May Compute" (retirement age, etc., etc.) by M. Reid (*20 cents*).

American Social Hygiene Assn., 50 West 50th St., New York, N. Y.

The Private Physician's Rôle in the New York City Syphilis Control Activities, by Clarke and Rosenthal . . . This Unofficial Grand Jury (prostitution finding and steps to take) by B. Johnson (*10 cents*) . . . Gonorrhea—Step-child of Medicine, by E. L. Keyes (*10 cents*) . . . Catholic Attitude Toward Some Hygienic Legislation, by F. P. Cavanaugh . . . Advice from a Lawmaker (drafting legislation, arousing public opinion, leadership) by T. C. Desmond (*10 cents*).

FROM THE HOUSE ORGANS

Vigorous editorials or "letters to the editor" on public health topics and quoted from 4 newspapers in *Bulletin,* Dept. of Health, Lincoln, Neb.

The Jenner inquiry has brought to us a life sketch of Eduardo Jenner, "Heroe de la Medicina Preventiva," in *Saludy Sanidad,* Secretaria de Sanidid y Beneficeneia, Havana, Cuba.

Probably most of our active educators already are on the mailing lists of *Briefs,* Maternity Center Assn., 1 E. 57th St., New York, N. Y. It brings a wealth of material " for those interested in promoting better maternity care in the United States."

The Bulletin, issued by the 3 national nursing bodies, 50 West 50th St., New York, N. Y., seeks to facilitate being passed around the office. A routing blank is printed in the upper right hand corner of the first page. Under " Pass On To: " are 5 blank spaces for initials or names.

" The Problem of Marihuana " is reprinted by *Connecticut Health Bulletin,* Hartford (Nov., 1938), from *Connecticut Policemen's Journal* for which the article was written by Dr. Millard Knowlton, of the State Department staff. The same issue includes " Planing Ahead for Connecticut's Health," a broadcast explaining the local health department.

Some simple methods for " Teaching People to Drink Milk " are mentioned by J. V. Latimer in Commonhealth Massachusetts Department of Public Health, Boston. Oct.-Dec., 1938.

" 25 Searching Questions " about local health education activities are asked in *Bulletin,* National Tuberculosis Assn. (Feb., 1939). Although directed to the tuberculosis groups, in connection with the Early Diagnosis Campaign, they largely have pertinence as to the health education activities of other groups. See a copy at the local tuberculosis society office. We wish that some one would write a series of " searching questions " for the local health department to use.

REPORTS

" Po-sho-a-neen - azhe-be-ma - de - ze - yun " (" Hello! How is your health today? ") and a picture of an Indian Princess, Watassa, appear on the cover page of Michigan Tuberculosis Assn. annual report for 1938. Several good 2 page spreads of pictures and captions make the report unusually graphic. The 2 pages on health education are well done.

" Guarding the Health of Kern County," annual report of Kern Co. Dept. of Public Health, Bakersfield, Calif., adds two significant words to the formal note of presentation: " To *the Citizens* and the Honorable Board of Supervisors." As is so usual, important material is placed in the back where it is likely to be missed by many readers. " Future Goals " and acknowledgments for services rendered seem to deserve a place up front.

The department in a city under 50,000 population might well look over the mimeographed annual report of Middletown, N. Y. To transplant the idea would mean mimeographing 12 sheets on a pleasing ivory paper, with plenty of paragraphs, abundant space between paragraphs. Bits of illustration can be copied from various sources, the copying being done by the girl who is good enough to make properly the typewritten stencil. The health officer or his secretary may not be inclined to lighten the report as freely as is done in Middletown, but with the right paper, spacing, and good stencil making, he will have a report that many citizens will read with pleasure. The 1938 Middletown report does not mention the local population, which the nonresident reader might like to know.

"An Appraisal of East Orange's Health Work " claims *the first page after the cover* of the East Orange, N. J., annual report. This page is a group of horizontal bars with solid black to represent the deficiencies in each 100 per cent based on the appraisal form. Next in the report comes a 3 page " Contents," detailed and in good sized type. *After that* comes the formal statement to the Mayor and City Council, followed by

the Health Officer's 3 page introduction. Popular health instruction is given 2 pages. Next to the last heading is given "Recommendations," which seems a mistake. It may not be logical (to some minds), but surely there would be a far greater reading of the "Recommendations" if they were placed immediately after the introductory pages.

One paragraph from "Foreword" of the "winter issue" of *Delaware Health News* (Dover, Del.), and the chapter headings are quoted below:

As time passes, new public health methods are developed, new needs arise, old health enemies are conquered and new ones challenged. Each of these changes represents a new problem. To lay these problems, clearly and concisely, before the people of Delaware is the purpose of this, the winter issue, of the *Delaware Health News*.

Expenditures and Health . . . We Challenge New Opponents! . . . Assume Responsibility! . . . Santa Claus in a New Rôle . . . Give TB the Knockout Blow! . . . Lifting One Hundred Pounds . . . The Laboratory Is Crowded . . . The Needs of the Health of Delaware.

"A Sight Saving Odyssey." How is that for the title of an annual report? Thus is introduced the 1937–1938 record of Illinois Society for Prevention of Blindness, 203 N. Wabash Ave., Chicago, Ill. There are 28 pages, 5½ by 7 inches, on ivory rough finished paper, blue cover, with the officers on the page after the title and the financial report on the last page, and not a heading between. But it survives that handicap more easily than most reports. This is due to the small size of the pages, the wide margins, the size and readability of the type, the leading between lines, and the lively, narrative style, all in the first person, being report by the Secretary, Audrey M. Hayden. It is no formal "Report of the Executive Secretary." The title origin:

. . . I want to describe to you, if I can, a Sight Saving Odyssey—an Odyssey that covered 67,786 miles this past year—an Odyssey that carried the message of light to 622 towns scattered through all of the 102 counties of Illinois.

MOVIES AND SLIDES

"Preparing Sound Film Strips," by C. R. Thomas. *Educational Screen*. 64 E. Lake St., Chicago, Ill. Oct., 1938. *25 cents*.

Full details described and illustrated, of steps in production of effective teaching material in the form of sound-film-strips.

"We Filmed an Idea" might stimulate workable ideas in presenting health; "How Long Is a Scene?" should help to guard against over-long and too short shots in amateur movies; "Undressing the Act" points to taking the clutter out of indoor scenes; "They Missed Ten Best" explains why certain good movies of 1938 failed to win a place in the annual awards (quite practical); "The Clinic" describes and illustrates short cuts and home-made devices. *Movie Makers*, 420 Lexington Ave., New York, N. Y. Jan., 1939. *25 cents*.

"Survey on the Utilization of Visual Aids" is based on returns from about 700 schools. Devoted largely to motion pictures, with limited attention film strips, slides, stereographs, etc. Gives a concise view of current practice. It is interesting that 31 per cent of the schools reporting use 16 mm. cameras "for producing films of school activities for exhibit to parents and community groups." Many teachers reported making movie records of special classroom projects. (We wonder if local health people have been coöperating in either direction to secure health pictures.) Victor Animatograph Corp., Davenport, Ia. *Free*.

"A School Club's Film," by H. R. Clifford in Feb., 1939, *Movie Makers*, 420 Lexington Ave., New York, N. Y. (*25 cents*), tells how a junior school group learned to produce their own pictures. A project ahead:

We are working in conjunction with the Safety Commission, another special interest class, on a safety film. We can get plenty of generalized safety films from automobile clubs, the police, etc., but we think it will be worth while to make one of our own that will show the hazards of the blind corners in our neighborhood and that will emphasize the particular habits of our boys and girls which need correction. Furthermore, we think that, even if the film is not outstanding (of course, we are going to do our best), the very fact that sixty boys and girls in the school are thinking, planning and working on a safety problem for several months should make the entire school more safety conscious and more careful.

RADIO

The Health League of Canada (105 Bond St., Toronto) has provided a series of 30 talks which are being broadcast locally over 33 stations in 9 provinces.

"The Hospital Breaks Out of Its Walls," by Dr. H. E. Kleinschmidt, is an effective example of the radio talk, and the title of a radio talk. Tells of the extension of hospital services. In *Hospitals*, 18 E. Division St., Chicago, Ill. Nov., 1938. *50 cents.*

MAGAZINE ARTICLES

Magazine articles don't take the place of educational material issued by health agencies, but they do have a lot of supplemental values. Are we getting full value from the magazine circulation in our state or city?

"City Doctor," by J. H. Jerger, M.D. *American Magazine*, Springfield, Ohio, Feb., 1939. *25 cents.* "Dictators in Our Hospitals," the case for the general practitioner in city as well as country.

"Let's Wipe Out T.B." Editorial. *Collier's.* Oct. 29, 1938.

"Death to the Killer," by J. D. Ratcliff. *Collier's.* Dec. 24, 1938. "A chemical agent has come to the aid of medicine in its battle against . . . pneumonia."

"Bedtime Story," by H. Lees. *Collier's.* Jan. 14, 1939. "Scientists have proved that a good rest doesn't necessarily mean unbroken sleep."

"The War on Syphilis." Editorial. *Collier's.* Feb. 4, 1939.

"*Collier's* two years ago (issue of Feb. 6, 1937) became the first popular magazine to utter the word 'syphilis' in cold type, and to talk about this national health termite and its possible extermination in calm, realistic language."

"The Strange Ways of Allergy," by G. W. Gray. How strange they are, their nature; . . . is there a way out? The writer has been highly praised for lucidity, and a passion for accuracy. *Harper's*, 49 E. 33rd St., New York, N. Y. Jan., 1939. *40 cents.*

Under "The Five Sisters" is a bar diagram "record of comparative mental ability at different months." Even without the rather inconspicuous color the diagram is an effective example of how standard diagrams may be dressed up. "Dentistry" is 10 pages of pictures and text illustrative of the makings of an effective exhibit. *Life*, 330 E. 22nd St., Chicago, Ill. Jan. 16, 1939. *10 cents.*

"Sleep Pills . . . Friends or Enemies?" "Did you know . . . that these popular, non-habit-forming pills . . . may be poison to you?" *Look*, Des Moines, Ia. Oct. 11, 1938. *10 cents.*

Seven pages of pictures showing the how and what of automobile accidents; one page. "Of these 8 Babies, 5 will be killed or injured before they are 60." *Look*, Des Moines, Ia. Dec. 6, 1938. *10 cents.*

"The Doctors' 'Union.'" The current case of A.M.A. vs. Dept. of Justice is not "union vs. non-union." It is the Sherman Act and personal conduct. *New Republic*, 40 East 49th St., New York, N. Y. Sept. 7, 1938. *15 cents.*

"What Aspirin Does to You," by T. S. Harding; "Inoculation for Your Child" (with "Children's Inoculation

Chart"), by G. E. Pendray; "The *Only* Fattening Food" ("is too much of all foods"), by J. A. Tobey (Sensible "Reducing"). *Your Life,* 354 4th Ave., New York, N. Y. Nov., 1938. *25 cents.*

USING THE MAIL

The 4 page letterhead has its place in the educational as well as administrative correspondence of health agencies. The latest we have noted is for a money-raising letter issued by American Social Hygiene Assn., 50 W. 50th St., New York, N. Y. Letter on first page; committee names and officers on second page: "an 8 point program" stated in detail on third page; fourth page left blank. This form seems better in some cases than an extra, different sized enclosure. Probably the association will send a copy on request. For many uses the two inside pages could be lightened by the use of well laid out pictures, the text being limited as much as possible.

A simple way to give a bit of distinction to our mail is to use the special commemorative postage stamps as they appear. When not available locally they can be secured through the official Philatelic Agency, Washington, D. C. At all times a certain variety of back special issues are offered by the Philatelic Agency. Send postal card for a list when you wish to purchase. Feb. 18, 1939, a "Golden Gate International Exposition Commemorative Stamp" will be put on sale in San Francisco, and may soon be offered in other cities.

Imprinted on envelopes by the postage meter of Baltimore Dept. of Health:

YOUR TAX DOLLAR
GIVES
SECURITY
HEALTH PROTECTION
EDUCATION
RECREATION

SCHOOLS

"Dental Health Education," preschool and beyond, is presented in *Iowa Public Health Bulletin,* State Dept. of Health, Des Moines, Ia. Oct.-Dec., 1938.

"Dental Hygiene: A Guide to the Dental Hygiene Program in the Schools of New York State" is fourth in a "Health Education Series." University of State of New York, Albany, N. Y.

Essays by about 100,000 students were entered in the 1938 contest conducted by the Committee on Tuberculosis among Negroes. The winners are reported in the Jan., 1939, issue of *Bulletin,* National Tuberculosis Assn., 50 W. 50th St., New York, N. Y.

"Evaluation of a Rural School Health Education Project: A Study of Pupil Health Practices," by Grout and Pickup, is particularly helpful for its analysis of the problem, and the statements running through the report as to the limitations of the methods employed. *Milbank Memorial Fund Quarterly,* 40 Wall St., New York, N. Y. Oct., 1938. *25 cents.*

"Health Education" is one of the usual headings over reviews and notes in *Public Health Reviews,* Division of Hygiene and Public Health, University of Michigan, Ann Arbor.

"Health Education in the Michigan Curriculum Program," by G. R. Koopman, presents attitudes and understandings and "nature of an effective program." *Michigan Public Health,* Lansing. Nov., 1938.

The school journey, tour, or excursion has long been a recognized educational device. Have health agencies sought for opportunities to coöperate? "School Tours" is a preliminary report on what schools are doing in trips more than one day in time length. *Free* from U. S. Office of Education, Washington, D. C. Reports are invited from schools, as well as suggestions for making better use of the tour idea.

BOOKS AND REPORTS

The History of Bacteriology—*By William Bulloch, M.D. New York: Oxford University Press,* 1938. 422 pp. Price, $3.75.

Dr. Bulloch has rendered a service to bacteriologists and to the medical profession in general in giving us this history. In 1930 he wrote the chapter on the History of Bacteriology in that monumental work, *System of Bacteriology,* published by the Medical Research Council of England. In 1937 he gave the Heath Clark Lectures, in which he discussed the development of bacteriology, covering much of the same ground as in his history, but adding greatly to its volume. This book is the result.

The author comments on the curious fact that so little has been written on the history of bacteriology. The only book he knows of in which an attempt to study the development of the history of the science was written by Loeffler in 1887, only the first part of which was published. Since Loeffler has been dead some 25 years there seems to be no hope that the second volume will ever appear.

From the small beginnings in 1675, when van Leeuwenhoek saw minute living creatures in rain water, down to the present, a new science has developed which has reached astonishing dimensions. The author has traced the building up of this knowledge, "often by laborious efforts, by tortuous routes, and sometimes through trackless wastes. But one thing is certain: the science of bacteriology is built on broad and sound foundations."

One is reminded again and again in reading this book of the fact that ". . . it is a sign of a dry age when the great men of the past are held in light esteem" (Osler). With no desire to belittle the work of modern scientists it must be pointed out that the men of whom this book tells were pioneers without what we now consider even moderate laboratory equipment, and often had to combat prejudices sometimes due to religious, ethnological, or other experiences. There were then no honors such as the Nobel Prize, for example, to be awarded. There was no incentive except a love for the scientific truth to urge them on. As a typical example of this, take the work of Bretonneau (1778–1862). While he is remembered by those who remember him at all as the first man to make a careful study of diphtheria (his essay on this subject is a classic than which nothing better has ever been written), he deserves perhaps more credit for being the real founder of the doctrine of specificity of disease as we understand it today. His conclusions came in the face of powerful tenets to the contrary, especially that of Broussais, who through the important position he held at the Val-de-Grace school exerted enormous influence on the medical thought of the time.

The book is logically arranged in chronologic sequence and shows evidence of an enormous amount of research work. That it is marked by accuracy goes without saying.

A well selected bibliography arranged according to the chapters of the book

occupies 65 pages. There are also some 56 pages given to short biographical sketches of early workers in bacteriology. This includes such men as Appert, for example, who did his remarkable work before there was such a thing as a science of bacteriology.

The book is well illustrated and especially valuable in giving excellent illustrations of some of the early apparatus used in the study of bacteriology. We wish this work could be made a part of required reading for all students of bacteriology. The printing and make-up are of the best.

MAZŸCK P. RAVENEL

Housing Yearbook 1938—*Edited by Coleman Woodbury. Chicago: Public Administration Service (1313 E. 60 St.)* 1938. 315 pp. Price, $3.00.

This fourth annual "Yearbook of 1938" outlines in a series of papers and reports some of the highlights of the advance of housing along all fronts during the year 1937. Leaders in five Federal Housing Agencies discuss in individual papers the progress made in their respective fields.

Some 78 pages are devoted to a rather complete summary of housing progress made by states and cities.

A "project roll call" lists large-scale rental housing projects giving their location, name, number of living units, owner, supervisory agency, and financial objective. There are other articles on neighborhood rehabilitation, national appraisal forum, foreclosure-procedures and policy, housing in the Third Reich, British housing in 1937, housing management, homestead tax exemption, Greenbelt Towns, architects in housing, and housing in Canada—all of these by leaders in their particular fields.

Coleman Woodbury, Director of the National Association of Housing Officials, and Editor of this book, sums up a busy year in housing progress along all of the various fronts and outlines the accomplishments and plans for the National Association of Housing Officials. A personnel of committees; a directory of housing agencies of the nation, state and municipalities; a list of new worth while publications, and, a selected bibliography are given in the last 50 pages of the book.

The reviewer was particularly impressed with a paper by Will W. Alexander, Administrator, Farm Security Administration, who wrote on, "Housing Activities of the Farm Security Administration." He states:

> The principal job of the Farm Security Administration is to help farm families on or near relief to become self-supporting. Since 1935 it has helped more than 532,000 low-income families to struggle back toward self-reliance and in helping such people reëstablish themselves, the Farm Security Administration inevitably was drawn into the field of housing. By January 1, 1938, the Farm Security Administration had completed about 3,370 homes on resettlement projects, and had nearly 7,000 more under construction. The mean value of all farm dwellings in the United States is only $1,126 and the median farm tenant home is worth only $472. It is clear, therefore, that families in need of Farm Security Administration can afford only the simplest kind of housing, compatible with minimum standards of sanitation and comfort. When the Resettlement Administration was incorporated in the Department of Agriculture on January 1, 1937, it was determined that the cost of farm homes should be held below specific levels, ranging from $1,200 to $2,100 in different sections of the country. In general, these homes are now being built for as little as $250 a room without bath and $300 a room with bath.

It seems to the reviewer that if the aims and motives contained in these statements by the Farm Security Administration were made the aim and motive force back of our federally directed urban housing movement, public health authorities would certainly become intensely interested overnight in housing.

In the first article in the yearbook the first purpose of the United States

Housing Act as outlined by Katherine K. Bauer, is given as follows:

> To provide financial assistance to the states and political subdivisions thereof for the elimination of unsafe and insanitary housing conditions, for the eradication of slums, for the provision of decent, safe, and sanitary dwellings for families of low income, and *for the reduction of unemployment and the stimulation of business activity* . . .

It would seem that the last twelve words of this statement of purpose should be an incidental result rather than a driving purpose of any fundamentally sound program to provide minimum standard housing for the poor.

This book is full of thought provoking articles for health officials having any interest in the housing movement of today.

ALFRED H. FLETCHER

The Adolescent—*By Ada Hart Arlitt, Ph.D. New York: McGraw-Hill,* 1938. 242 pp. Price, $2.00.

Adolescence, between 12 and 21 years of age, is probably the most difficult time in an individual's life, most trying, not only for himself but for the adults who are to guide him. He does not understand his own feelings, his own rapidly maturing body, his constant struggle to make himself felt as an individual. Frequently he is a member of a family in which the parents do not wish their children to grow up to become individuals independent of them; and so, to himself and to his parents, to his teachers and to other adults who come in contact with him he is a very puzzling individual, and all too frequently is called a problem.

Dr. Arlitt's book is one which could be read with profit by all adults. She gives practical advice on ways of meeting the problems of this age in language which makes delightful reading and which shows a rare and sympathetic understanding of adolescence.

ETHEL GORDON

A Manual of Tuberculosis: For Nurses and Public Health Workers—*By Ashworth Underwood. Baltimore, Md.: Wood,* 1938. 404 pp. Price, $3.25.

In the light of modern developments in tuberculosis control, the increase in the practice of chest surgery, and the more recent conceptions of the method of tuberculous infection in the child, the author has completely revised the earlier edition of this volume which was published in 1931. Three new chapters have been added describing briefly administrative phases of tuberculosis work.

With an orderly presentation of material the book has 18 chapters, the first two of which describe in plain language the general nature of tuberculosis; then come chapters on symptoms, signs, and the course and complications of pulmonary tuberculosis. Following are discussions of sanatorium and medical treatment of the disease with special reference to collapse therapy, operative methods, and diagnosis of treatment. Individual chapters are devoted to tuberculosis in children, and tuberculosis of bones and joints. The use of tuberculin and laboratory methods of diagnosis are given a full chapter. There is a detailed description of nursing duties in sanatorium treatment and on the private nursing of tuberculosis. Other chapters are devoted to light therapy, disinfection, the duties of the nurse in the dispensary, and the post-sanatorium regime including instructions to the patient.

The book was written primarily to prepare the nurse for work in the special field of tuberculosis, but its horizons are even more extensive. The descriptions are unusually clear, the language is simple. Fifty-three illustrations accompany the text. A useful glossary of technical terms and a bibliography for further study are provided. The sum-

maries at the end of the chapters form a syllabus on tuberculosis for nurses and public health workers who will find the volume an excellent source of information. BERNARD S. COLEMAN

Tuberculosis Hospital and Sanatorium Directory, 1938—*New York: National Tuberculosis Association*, 1938. 168 pp. Price, $1.00.

The National Tuberculosis Association has issued, as of May, 1938, an up-to-date Directory of Tuberculosis Hospitals and Sanatoria in the United States, including institutions in Alaska, Hawaii, Puerto Rico, and the Philippine Islands. Listed alphabetically according to location under the separate states and territories the names of the institutions, 749 in number, are followed by their dates of opening, the types of cases accepted, bed capacities, rates, qualifications of residence of patients admitted, the names of the superintendents and the medical directors, and the persons to whom application for admission should be made. A separate listing is given for Federal Sanatoria and Hospitals which provide facilities for the care of the tuberculous.

The Directory reveals the astonishing development that has occurred in tuberculosis hospital care in the United States since Dr. Edward Livingston Trudeau opened the "Little Red," the cottage of two beds in Saranac Lake in 1885. The erection of sanatoria in state after state following Trudeau's demonstration has been a constant and progressive development until there are now available in continental United States 732 institutions with close to 90,000 beds. Alaska, Hawaii, Puerto Rico, and the Philippine Islands have 17 institutions with approximately 3,100 beds. If and when the hospitals now under construction or definitely provided for are completed there "should be available within the next few years approximately 98,000 beds." This edition of the Directory shows an increase of 5,869 beds since 1934 when the previous edition was published.

The Directory is useful to tuberculosis specialists, tuberculosis and health associations, departments of health, hospitals, and public welfare, and should be on the desk, for ready reference, of every health and hospital information service in the country. It provides "quick" information. The volume is well printed and has been indexed thoroughly. BERNARD S. COLEMAN

Annual Report of the Surgeon General of the Public Health Service of the United States for the Fiscal Year 1938. *Washington: U.S. Government Printing Office*, 1938. 184 pp. Price, $.60.

This small volume contains a wealth of information of great interest. Not only does it tell of health conditions in this country but there is also a brief report concerning those in the world in general. Unfortunately such reports are at least 6 months old and sometimes more before they are published.

In the world there were 198,389 cases of cholera reported for 1937, with 101,201 deaths, of which 86 per cent occurred in India. Only 1 case with death was reported in the Philippine Islands. There were 36,000 cases of plague with 22,000 deaths, an increase over 1936. There were reported 137,856 cases of smallpox with 28,000 deaths, a great proportion of which—104,974 cases with 26,447 deaths—occurred in India. Unfortunately, "the United States continues to hold its unenviable position near the top among the nations reporting smallpox incidence. For 1937, 48 states reported a total of 11,673 cases of smallpox, as compared with 7,834 for 1936 and with 7,957 for 1935. The number of cases for 1937 is the highest since 1931, while the number of deaths (30) compares favorably with the average of 26 per

year for the preceding 3 years." Of yellow fever there were 314 cases with 290 deaths, 13 cases of which, with 8 deaths, were the jungle type reported from Peru. The disease was practically confined to Africa and South America. All continents reported the prevalence of typhus fever, with a total of 30,326 cases with 1,753 deaths, an increase over 1936.

For the United States general conditions were favorable. In spite of a small epidemic of influenza during the first quarter of the year, the general death rate for 40 states, District of Columbia, and Hawaii, representing 85 per cent of the total population of the country, was 10.9 per 1,000 as compared with 11.3 for 1936. These figures are preliminary and the final corrected rates by the Bureau of the Census will differ somewhat. However, the provisional rates of the Census indicate a decrease of 3 per cent in 1937 over 1936. These favorable health conditions continued into 1938 and the rate for the first half of 1938 was 10.8 per 1,000, as compared with 11.8 for the corresponding period of 1937. The infant mortality rate showed a decline of more than 8 per cent and maternal mortality also showed an encouraging decrease—from 5.3 for 1936 to 4.6. The tuberculosis mortality rose in 1936, but in 1937 the downward trend was reestablished, standing at 49.6 for all forms against 51.7 for 1936.

Studies in Rocky Mountain fever have continued and the known area in which it is found has been extended to include all geographic regions of the United States, New England being the last to recognize its occurrence, with 4 cases reported in Rhode Island in 1937. In all, there were 431 cases and 86 deaths for 1937.

New low death rates were recorded during 1937 for typhoid fever, scarlet fever, diphtheria, tuberculosis, malaria, pellagra, nephritis, and diseases associated with pregnancy and childbirth.

The leading causes of death for 1937, according to preliminary data, were diseases of the heart, cancer and other malignant tumors, pneumonia (all forms), cerebral hemorrhage and softening, nephritis, accidents (except automobile), and tuberculosis, in the order named.

The personnel of the Service as of July 1, 1938, consisted of a total of 481 officers, of whom 60 were on waiting orders. On the same date the number of reserve officers on active duty was 91. There were also on that date 726 Acting Assistant Surgeons.

The report contains interesting sections telling of the researches being done in the Division of Domestic Quarantine (States Relations), being the public health program under title VI of the Social Security Act.

The whole report is full of meat, but is in such detail that it does not lend itself readily to review. It must be read to be appreciated.

The United States is fortunate in having in the Public Health Service one of the largest, best equipped, and best trained forces of men in public health work that the world affords.

MAZÝCK P. RAVENEL

Foods: Production, Marketing, Consumption—*By Jean J. Stewart. New York: Prentice-Hall,* 1938. 737 pp. Price, $3.25.

From crop production to table etiquette here is a book replete with information about foods and of real value to the health officer, nurse, physician, dietician, and food technologist. As much at home in the classroom as in the reference library of a research laboratory, this comprehensive volume will stimulate the layman to think more about foods and at the same time awaken an interest in the expert. The text is well written and easy to read, supplemented, as it is, by illustrations,

charts, and tables. The author has successfully attempted to discuss man's food problems from production and marketing to consumption and human nutrition. No small value lies in the up-to-date bibliography at the end of each chapter.

A description of the individual foodstuffs is presented including a survey of the industry, chemical and bacterial significance, and nutritive values. Classification and government grades and standards are given in most cases. For those foods which are manufactured, a description of the processing steps and the theory behind each is developed including some discussion of the factors affecting quality. In one book covering such a broad subject too much exhaustive discussion cannot be expected. All topics are treated in a concise style but with surprisingly little sacrifice of detail except in very technical matters.

High carbohydrate foods, fruits and vegetables, fats and oils, meats and fish, poultry and eggs, and beverages are discussed in separate chapters. Other chapters include a study of man's relation to the food problem and the food needs of the individual, the family, and the nation. The latter deals with the factors and agencies concerned in promoting a national program of optional nutrition and with cleanliness and sanitation.

The author has taken a modern attitude in coördinating the interests of producers and consumers. However, the educational value of this book does not stop here. The public health worker will find it very informative not only in its text material but also in the appended charts of food consumption statistics and dietary values. In addition, there is a section on meal planning, cooking, and even table service; the food buying guides and shipping season charts are quite useful. Definitions for milk grades and standards for milk production as defined in the U. S. Public Health Service Ordinance are included, also a personal health data chart including height-weight-age tables compiled by qualified investigators.

A better understanding of the complex interrelationships involved in the social and economic aspects of food is desirable, and through education such as this books offers, life can be made more interesting and more efficient.

C. R. FELLERS

Gould's Pocket Pronouncing Medical Dictionary—*By George M. Gould, M.D. Revised by C. V. Brownlow (11th ed.). Philadelphia: Blakiston,* 1939. 1,056 pp., 218 pp. of tables. Flexible washable fabric binding. Price, $2.00; Thumb index, $2.50.

The eleventh edition of this standard work is in a handy size for the use of those for whom the full-size volume is unwieldy.

On the whole it would seem that the abbreviation involved in this small-size dictionary does not seriously reduce its usefulness to physicians, public health workers, medical writers, nurses and many others who need a readily accessible source of information for our rapidly increasing scientific vocabulary.

Having moved the tables to the Appendix, the main body of the volume of more than a thousand pages is left free for the definition of a surprising variety of terms. Any volume in this field which sells close to 900,000 copies has evidence of its utility.

REGINALD M. ATWATER

A Guide to Human Parasitology for Medical Practitioners—*By D. B. Blacklock, M.D., and T. Southwell, D.Sc. (3rd ed.). Baltimore: Wood,* 1938. 259 pp. Price, $4.00.

The authors are members of the faculty of the Liverpool School of Tropical Medicine. In this third edition most of the book remains the same

as before except for the inclusion of the most recent advances in knowledge. The chapter on malaria has been entirely rearranged in order to facilitate the study of the subject, and the section on Leishmaniasis has been largely rewritten in the light of the most recent investigations.

The book is a brief textbook for students of human parasitology and for practitioners in the tropics. It is on the whole very accurate with regard to the morphological characteristics and life cycles of parasites. The two colored plates and 122 illustrations in the text, most of which appear to be original drawings, are excellent.

An attractive feature which is rarely found in textbooks of parasitology is a series of charts showing the life cycles of most of the helminths. This is included in a section on diagnosis, which is inserted in the chapter on nematodes without being mentioned in the table of contents.

The value of the book is limited by the omission of important points connected with a number of parasites, such as the globulin tests in the diagnosis of kala azar. Clinical symptoms, treatment and prevention are entirely omitted throughout the book. The reviewer believes that the book would receive much wider approval, especially as a textbook for medical students, if these features were added.

HENRY E. MELENEY

Your Chest Should Be Flat—*By S. A. Weisman. Philadelphia: Lippincott,* 1938. 145 pp. Price, $2.00.

This exceedingly well conceived and orderly little book contains the report of a study of the thoracic measurements of 20,000 school children. The conclusion that the deep chested child is slightly more prone to tuberculous infection than the flat chested individual appears to be well substantiated. It still leaves us somewhat in doubt as to an adequate reason for this observation. The brief chapter on preventive measures is definitely suggestive. In this are recognized the handicaps imposed by substandard economic conditions. It might be suspected that these were the causes of both barrel chest and lowered resistance to infection by the tubercle bacillus. Even so, the careful research makes its significant contribution and represents a study of definite value.

The form and manner of presentation deserves high praise. If more research could be reported in so attractive a manner, its practical value would be notably increased. Illustrations, chapter summaries, and excellent bibliographies add much to the value of the book. Aside from the interesting conclusions regarding physical configuration and susceptibility, the many wise comments on tuberculous infection in childhood lend essential value to the book. It is strongly recommended to readers, both for its form and its content. KENDALL EMERSON

Fifth Avenue to Farm: A biological approach to the problem of the survival of our civilization—*By Frank Fritts and Ralph W. Gwinn. New York: Harper,* 1938. 282 pp. Price, $3.00.

This analysis of the problem of the eugenic quality of American civilization suggests that historically the best biological specimens have come from farms and small towns. Implications related to the effects of higher birth rates in the rural than in the urban areas, of the migration from farms to cities, and the responsibilities of American colleges and of churches in relation to problems of a changing society are considered. Students interested in population problems and in the interrelationships of the various factors of modern society will be par-

ticularly interested in this study which is likely to provoke controversy as well as to stimulate thinking regarding future trends. IRA V. HISCOCK

Sanitization of the Drinking Glass: Part One, Methods and Procedures—*By Jack G. Baker;* **Part Two, Practical Control,** *By Raymond V. Stone, D.V.M. Los Angeles: National Association of Sanitarians, Inc.,* 1938. 60 pp. Price, $.25.

This concise, comprehensive, handbook will be found a dependable guide by health officers and sanitary inspectors who wish to establish or improve methods which concern the sanitation of public eating and drinking establishments in their communities. The text is entirely practical and is written by individuals of experience who are convinced of the epidemiological significance of the subject which they have studied so systematically and constructively.

In Part One the fundamental demand for clean eating and drinking utensils is presented clearly; however, the difficulty of establishing conclusively exactly where and when infection takes place is definitely realized. It is only in studies made upon large groups under control that data of even approximate accuracy can be obtained.

The responsibility for the adequate sanitation of eating and drinking establishments is put squarely up to the health officer, where it truly belongs, but for a health officer to launch such a "program without giving thought to the industry is a serious mistake." Methods must be devised which are practical as well as effective, which take into consideration the availability of equipment, and which can be adopted and applied with ease and certainty. The fundamental purpose of this publication is to tell the health officer exactly how this is to be accomplished.

A well deserved tribute is given to individual service paper drinking cups. Their universal adoption would relieve the health officer of one of his most difficult administrative problems.

Probably no section of this work will be found more welcome than that which concerns Inspectional Procedures. Any campaign which has as its aim the sanitation of public eating and drinking establishments must depend, in the main, upon the conscientious work of the sanitary inspector. Even the bacteriological work of the laboratory is very secondary in its ultimate value. Much time has been spent by careful investigators in attempts to find the ideal bacteriological set-up. About all we actually need is a method whose results will indicate the difference between relatively clean and relatively dirty dishes and glasses. There is, however, the need for universal agreement upon a standard technic. There are two reasons for this—among others. The first is that a commonly accepted and applied technic is the only one which will enable health officers to compare the results of their work; the second is that an official standard method carries authority in a court of law. The health officer is already convinced of the value of standard methods; the laboratory man does not want his research hampered even by implication; and the sanitary inspector merely wants to know definitely and clearly what he is to do and how it is to be done. This text permits him to have no further doubt.

Part Two concerns Practical Control. In addition to his thorough discussion of laboratory procedures and the background for such work, Dr. Stone contributes his own observations upon a sediment test for the wash water. For making this test the Wisconsin or the Vacuum Sediment Tester is used. An ounce of the dish water is passed through, and then the disk is removed, pressed upon a small white card, and

dried. It can thus be preserved for any subsequent use, such as exhibition in court.

The tentative procedure suggested by the American Public Health Association Sub-Committee on Standard Methods for the Examination of Dishwashing Devices (published in the 1936–1937 *Year Book*) has been adopted by Dr. Stone. He finds that the temperature of the wash water should not go below 120° F., that the sediment tester makes bacteriological examination of the wash water unnecessary, and that an allowable rim count per drinking glass of 500 colonies is too lenient—he suggests a maximum of 100 colonies.

"An objection that 'standardization impairs progression by discouraging research' is not tenable. Actually research ideas carried concurrently with a standard procedure is the only way to evaluate the degree of superiority (or even inferiority) of the planned innovation. Standard Methods increase the research trend since a measuring rod exists which allows comparisons. Let there be more Standard Methods; more Tentative Methods and fewer Optional Methods."

This work is recommended without qualification to all persons interested in clean public drinking glasses.

A. PARKER HITCHENS

BOOKS RECEIVED

WATER SUPPLY ENGINEERING. By Harold E. Barrett and James J. Doland. 3d ed. New York: McGraw-Hill, 1939. 690 pp. Price, $6.00.

CLASS FERTILITY TRENDS IN ENGLAND AND WALES, 1876–1934. By John W. Innes. Princeton: Princeton University Press, 1938. 152 pp. Price, $2.50.

ANNUAL REPORT OF THE PUBLIC HEALTH COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1936. Volume 1, with Appendices. Manager of Publications, Government of India Press, New Delhi, India. New York: British Library of Information, 1938. 353 pp. Price, $1.00.

REHEARSAL FOR SAFETY. A Book of Safety Plays. By Fanny Venable Cannon. New York: Dutton, 1939. 132 pp. Price, $1.00.

POCKET PRONOUNCING MEDICAL DICTIONARY. By George M. Gould. Revised by C. V. Brownlow. 11th ed. Philadelphia: Blakiston, 1939. Over 1000 pp. Flexible, Washable fabric, $2.00. With Thumb Index, $2.50.

BULLETIN No. 1004. Vacuum Operated SterElators by the Everson Manufacturing Co. Chicago, Ill. The Bulletin may be had by writing to Everson.

FUNDAMENTALS OF PHYSICAL EXAMINATION. By George G. Deaver. Philadelphia: Saunders, 1939. 299 pp. Price, $2.75.

A SHORT ENCYCLOPEDIA FOR NURSES. By Evelyn C. Pearce. New York: Dutton, 1939. 686 pp. Price, $3.50.

A TEXTBOOK OF ORTHOPAEDIC NURSING. By Evelyn C. Pearce. London: Faber, 1939. 230 pp. Price, $2.50.

OH, DOCTOR! MY FEET! By Dudley J. Morton. New York: Appleton-Century, 1939. 116 pp. Price, $1.50.

EDUCATION OF THE HANDICAPPED. Volume 1. History. Edited by Merle E. Frampton and Hugh Grant Rowell. Yonkers: World Book Co., 1938. 260 pp. Price, $2.40.

SIR THOMAS RODDICK. HIS WORK IN MEDICINE AND PUBLIC LIFE. By H. E. MacDermot. New York: Macmillan, 1938. 160 pp. Price, $2.00.

EVALUATION OF A RURAL SCHOOL HEALTH EDUCATION PROJECT. Reprinted from The Milbank Memorial Fund Quarterly. By Ruth M. Strang, Ruth E. Grout, Dorothy G. Wiehl, C. A. Greenleaf and E. Genevieve Pickup. Free upon application to the Milbank Memorial Fund.

THE SCHOOL HEALTH PROGRAM. Report of the Regents' Inquiry. By C.-E. A. Winslow. New York: McGraw-Hill, 1938. 120 pp. Price, $1.50.

A SELECTED PUBLIC HEALTH BIBLIOGRAPHY WITH ANNOTATIONS

RAYMOND S. PATTERSON, PH.D.

Safety Last—As the price we pay for our "glorious fourth" we can mark up 25 deaths (mostly little girls burned by sparklers setting fire to flimsy clothes and big boys killed by home-made explosives) and about 8,000 cases of serious injuries such as the loss of eyes, arms or fingers. New Jersey, with an effective fireworks ban had the lowest score, while across the Delaware River, the Keystone State had the distinction of killing and maiming the most.

ANON. Second Annual Summary of Fourth of July Injuries. J.A.M.A. 112, 3:236 (Jan. 21), 1939.

Dental Defects and Diet—All free sugar was taken from the diet of institutional children, a diet which, incidentally, was inadequate from the standpoint of the protective foods. Despite evidences of malnutrition, from 80 to 90 per cent of the children became free of dental caries. Also the oral acidophilus disappeared. When candy and free sugar was fed, the salivary acidophilus bacillus returned and after a period so did dental caries. Acid-producing bacteria determine the occurrence of caries regardless of all other factors. A diet of starches and sugars only affects these germs. If these findings are accepted by all authorities, health educators are going to have a lot of "un-learning" to do.

BUNTING, R. W. Diet and Dental Caries. New York State J. Med. 39, 1:18 (Jan. 1), 1939.

Sprayed Apples and Cabbages—Hinting darkly of "dirty work at the crossroads" this paper pictures the possibility of unrecognized chronic poisoning by the lead, arsenic, and fluorine used as fruit and vegetable sprays. Difficulties in nutritional research are presented in considering the need for control.

CARLSON, A. J. Some Complications in Nutrition Research. J. Am. Dietet. A. 15, 1:1 (Jan.), 1939.

Why Filing Cases Multiply—Record keeping is considered so important in public health nursing that visits are not counted unless the case record is completed. To what use are the records put? It is assumed they are of value as an influence for more complete follow-up. In this paper it is concluded that the time spent in making the common type of entry is largely wasted in so far as that benefit is concerned. This is not a general condemnation of record keeping.

DERRYBERRY, M. Do Case Records Guide the Nursing Service. Pub. Health Rep. 54, 3:59 (Jan. 20), 1939.

Health for All—Another, and an excellent statement both of the need for, and the proposals to accomplish, a national health program addressed to staid New England, where there is a much more progressive attitude toward modern health problems than "Plymouth Rock" traditions would lead to one to expect.

DRAPER, W. F. A National Health Program. New Eng. J. Med. 220, 2:44 (Jan. 12), 1939.

Can You Remember What You Read?—These suggestions for student nurses about how to study, concentrate, and remember are worth perusal by any health worker who has difficulty making his mind behave. Six good

rules for mental efficiency end the discussion.

KITSON, H. D. There's Nothing Wrong With Your Mind! Am. J. Nurs. 39, 2:117 (Feb.), 1939.

What School Physicians Ought to Know—Herein is discussed the training of school physicians. It is proposed that institutes and teaching centers be created where physicians may learn the elements of school health work, and that educational standards be fixed by State Departments of Public Instruction.

KLEINSCHMIDT, E. E. Special Educational Qualifications for the School Physician. J. School Health. 9, 1:13 (Jan.), 1939.

Teaching About Cancer—Beginning a series of articles reviewing the symptomatology and treatment of cancer, this first paper promises a discussion of wider interest than just for the public health nurse to whom it is addressed.

KRESS, L. C. The Nurse's Part in the Control of Cancer. Pub. Health Nurs. 31, 2:85 (Feb.), 1939.

Fat Soluble Vitamins—Briefly and skillfully reviewed as in this article, the present-day knowledge of vitamins A and D can be made quite comprehensible to those of us who are not biochemists. The author concludes that an ample and varied diet rich in dairy products will supply all the fat soluble vitamins that the body needs, except during infancy, pregnancy, and lactation; then fish liver oils may be needed.

MEIKLEJOHN, A. P. The Fat Soluble Vitamins. New Eng. J. Med. 220, 2:67 (Jan. 12), 1939.

Twenty-five Colleges—Where to go for undergraduate training in sanitary and public health engineering.

MILLER, A. P. Undergraduate Engineering Training in Public Health and Related Activities in Engineering Colleges of the United States. Pub. Health Rep. 54, 2:29 (Jan. 13), 1939.

Nurses and Tuberculosis—Tuberculosis constitutes an occupational hazard for public health nurses. Although the number of open cases is decreasing, the nurse is often exposed to the disease. Her only defense is good communicable disease nursing technic. The only way she, or anyone else, can get the disease is from some one of her contacts who has it.

MYERS, J. A. Tuberculosis Among Nurses. Pub. Health Nurs. 31, 2:93 (Feb.), 1939.

Creating Good Will—Words of wisdom about the public relations of a municipal water company, every syllable of which would apply equally to any health agency. The paper is commended to all administrators, both for the needed lessons it contains and for the manner of its presentation.

NILES, P. B. Watering the Grass Roots. J. Am. W. W. Assoc. 30, 12:1917 (Dec.), 1938.

Preventing Pertussis — Double strength vaccine given subcutaneously in 3 weekly doses appears to confer practical protection. Passive immunity may be achieved by use of hyperimmune serum, if given before the paroxysmal stage is reached. These are two conclusions from an interesting paper reviewing the modern situation in regard to the disease.

SAUER, L. W. Whooping Cough. J.A.M.A. 112, 4:305 (Jan. 28), 1939.

ASSOCIATION NEWS

The attention of overseas public health workers is called to the extraordinary opportunity in 1939 of attending the meeting of the American Public Health Association and one or both of the World's Fairs in San Francisco and New York, where special emphasis has been laid on public health exhibits.

Sixty-eighth Annual Meeting, Pittsburgh, Pa., October 17–20, 1939
Headquarters: Hotel William Penn

APPLICANTS FOR MEMBERSHIP

The following individuals have applied for membership in the Association. They have requested affiliation with the sections indicated.

Health Officers Section

Erb. na Bangxang, M.B., C.P.H., 615 No. Wolfe St., Baltimore, Md., Deputy State Health Officer, Bangkok, Siam

Benjamin S. Black, M.D., Grove Hill, Ala., Clarke County Health Officer

Grover C. Bolin, M.D., Riverside Drive, Orangeburg, S. C., Director, Orangeburg County Health Dept.

Randolph L. Compton, M.D., Greenup, Ky., Director, Greenup County Health Dept.

John F. D. Cook, M.D., State Capitol Bldg., Pierre, S. D., Superintendent, State Board of Health and Medical Examiners

Benjamin M. Drake, M.D., Greensboro, Ala., Hale County Health Officer

Lenor S. Goerke, M.D., C.P.H., 324 Duane, Astoria, Ore., Clatsop County Health Officer

Adelard Groulx, M.D., C.P.H., Dept. of Health, City Hall Annex, Montreal, Que., Canada, Director

Reuben J. Harrington, M.D., Court House, Muskegon, Mich., Director, Muskegon County Health Dept.

Andrew Hedmeg, M.D., Box 332, Natchez, Miss., Director, Adams County Health Dept.

Roscoe P. Kandle, M.D., C.P.H., Tenth District Health Office, Clovis, N. M., District Health Officer

John R. Long, M.D., Marion, Ala., Perry County Health Officer

Bennie A. Moxness, M.D., 165 Capitol Ave., Hartford, Conn., Public Health Physician, Bureau of Venereal Diseases, State Dept. of Health

S. Stewart Murray, M.D., D.P.H., City Hall, Vancouver, B. C., Canada, Senior Medical Health Officer, Greater Vancouver Metropolitan Health Committee

J. Burris Perrin, M.B., C.P.H., 422 State Office Bldg., Denver, Colo., Director, Maternal and Child Health, State Health Dept.

John S. Robertson, M.D., D.P.H., P. O. Box 130, Yarmouth, N. S., Canada, Divisional Medical Health Officer

Livington B. Sheppard, M.D., Box 708, Paintsville, Ky., Johnson County Health Officer

Thomas B. Snoddy, M.D., Pala, Calif., Field Physician, Mission Indian Agency, U. S. Indian Service

Ellis D. Sox, M.D., C.P.H., 1501 W. Main St., Visalia, Calif., Tulare County Health Officer

Joseph H. Stickler, M.D., Stewart, Nev., In charge of Division of Health, Carson Indian Agency, U. S. Indian Service

Ernest Thompson, M.D., Monroe, Ga., Walton County Health Commissioner

Floyd R. Town, M.D., Mt. Pleasant, Mich., Director, Isabella County Health Unit

Ralph M. Vincent, M.D., M.P.H., 65 Broad St., Rochester, N. Y., Assistant District State Health Officer

Harry Wain, M.D., 612 S. Gilbert St., Ada, O., Physician in charge of Health Service and Instructor of Pharmacy, Ohio Northern University

Frank E. Wilson, M.D., Williamston, N. C., Martin County Health Officer

Laboratory Section

Luther Bowen, Ph.G., 6 N. 4th St., Martins Ferry, O., City Chemist, Dept. of Health

Maurice M. Cahn, B.S., 118 East 28 St., New York, N. Y., Director, Royal Laboratories

Dr. Alne E. Cameron, Health of Animals Division, Department of Agriculture, Ottawa, Ont., Canada, Acting Veterinary Director General

R. S. Fassnacht, A.B., City Hall, Salina, Kans., City Milk Inspector

Barbara N. Johnson, B.S., 837 N. Lafayette Park Place, Los Angeles, Calif., Clinical Laboratory Technician, State Dept. of Public Health

Abraham J. Krell, B.S., Catskill Laboratory, Bureau of Water Supply, Ashokan, N. Y., Bacteriologist

Virginia Moss, 2413 Ronda Vista Drive, Los Angeles, Calif., Student Technician, Los Angeles County Laboratories

Robert C. Perriello, B.S., City Hall, Attleboro, Mass., Public Health Agent and Bacteriologist, City of Attleboro

Dorothy J. Williamson, 5960 Chabolyn Terrace, Oakland, Calif., Student, University of California

Vital Statistics Section

Fern E. French, B.S., 3583 Life Sciences Bldg., Berkeley, Calif., Associate in Vital Statistics, Curricula in Public Health, University of California

Harrison S. Martland, M.D., City Hospital, Newark, N. J., Pathologist, and Essex County Chief Medical Examiner

Public Health Engineering Section

William H. Bates, Millen, Ga., District Supervisor, U. S. Public Health Service

George H. Eagle, B.C.E., State Dept. of Health, Columbus, O., Assistant Engineer

Carson C. Foard, Box 155, Burnsville, N. C., Sanitarian, Avery-Yancey Health Dept.

Ralph E. Fuhrman, B.S. in C.E., Sewage Treatment Plant, Blue Plains, D. C., Assistant Superintendent

Edward Gerner, 129 Main St., Orange, N. J., Sanitary Inspector

Nelson Hall, City Hall, Saginaw, Mich., Supervisor of Sanitation, Dept. of Health

Gus R. Herzik, Jr., M.S., 808 East 30 St., Austin, Tex., Principal Assistant Engineer, State Dept. of Health

Albert W. Hutchison, Jr., B.E., LL.B., Vanderbilt University, Nashville, Tenn., Director, Short Course for Sanitarian Assistants and Assistant Professor of Civil Engineering

Fred J. Lewis, C.E., Vanderbilt University, Nashville, Tenn., Dean, School of Engineering

Henry C. Mitchell, C.E., Box 239, Hopewell, Va., Health Engineer, Prince George-Hopewell Health Dept.

George A. Perkins, 112 E. Daniel St., Champaign, Ill., Student in Sanitary Engineering, University of Illinois

George W. Schucker, B.E. in C.E., 1101 N. Bentalou St., Baltimore, Md., Chief, Division of Community Sanitation, City Health Dept.

David Smallhorst, 519 Furman, Corpus Christi, Tex., Sanitary Engineer, City-County Health Unit

Charles D. Spangler, C.E., McLeansboro, Ill., District Sanitary Engineer, State Health Dept.

S. Merkel Sperry, 1804 Olive St., Reading, Pa., Chief Chemist, The Utility Management Corporation

Ferdinand A. Yost, 1918 Arthur Avenue, New York, N. Y., Health Inspector, Dept. of Health

Ernest W. Zickert, Court House, Janesville, Wis., Sanitarian, Rock County Sanitary Unit

Food and Nutrition Section

Clyde L. Kern, D.V.M., 11 West 42 St., New York, N. Y., Chief Veterinarian of Quality Control Division, Dairymen's League Cooperative Assoc., Inc.

Child Hygiene Section

Amos Christie, M.D., University of California Hospital, Parnassus & Third Ave., San Francisco, Calif., Lecturer on Maternal and Child Health, Curricula of Public Health

Public Health Education Section

Flora Beutel, 119 Stone, Peoria, Ill., School Nurse

Mrs. May W. Bevens, 125 Oakland Ave., Helena, Ark., Chairman, Public Welfare Dept., General Federation of Women's Clubs

Dale A. Boarts, 116 N. W. Temple, Salt Lake City, Utah, with Lederle Laboratories

James M. Doughty, Jr., A.B., Box 352, Tucumcari, N. M., District Sanitarian, Tenth Health District

Francis W. Manning, B.S., 502 Newberry Ave., Newberry, Mich., Sanitarian, District Dept. of Health

Clara Pennington, 207 Majestic Bldg., Fort Worth, Tex., Executive Secretary, Fort Worth-Tarrant County Tuberculosis Society

Evelyn M. M. Reidy, A.M., LL.B., 2300 Loring Place, Bronx, N. Y., Secretary, Bronx County Medical Society

Ora G. Ringer, R.N., College St., Wadsworth, O., School Nurse

Joseph Slavit, M.D., 2732 Bedford Ave., Brooklyn, N. Y., Medical Inspector, New York City Dept. of Health

Public Health Nursing Section

Georgia C. Bankhead, R.N., Snowflake, Ariz., Public Health Nurse

Mary Beard, D.Litt., American Red Cross, Washington, D. C., Director, Nursing Service

Bertha L. Brown, R.N., 1323 Wells, Ann Arbor, Mich., Student, University of Michigan

Margaret C. Butts, B.S., 40 Monroe St., New York, N. Y., Local Supervisor, Queens Western Staff Nurses, Metropolitan Life Insurance Co.

Constance E. Carmody, B.A., R.N., Marathon County Health Department, Wausau, Wis., Assistant County Nurse

Fannie L. Cott, R.N., Johnson, Kans., Public Health Nurse, Stanton County Public Health Service

Carlista L. Crown, 305 State Bldg., San Francisco, Calif., Assistant Chief, Public Health Nursing Service, State Dept. of Public Health

Ruth M. Dickerson, R.N., Cimarron, Kans., Gray County Public Health Nurse

Grace B. Hanson, B.S., 1014–4 St., S. E., Minneapolis, Minn., Student, University of Minnesota

Clara E. Hoffman, R.N., Fort Duchesne, Utah, Field Nurse, U. S. Indian Service

Henrietta Hofmann, 121 Bank St., New York, N. Y., Assistant Supervisor, Henry Street Visiting Nurse Service

Anneke Kollewijn, Box 931, Cortez, Colo., Montezuma County Public Health Nurse

Mary E. McKay, B.S., 102 Federal Bldg., San Francisco, Calif., District Supervisory Nurse, U. S. Indian Service

Amye McKee, R.N., Goldendale, Wash., Klickitat County Public Health Nurse

Alma J. Nielsen, Box 163, Oakley, Kans., County Public Health Nurse

Nina D. Petersen, R.N., Ogallala, Nebr., Staff Nurse, State Dept. of Health

Madeleine M. Putnam, B.A., B.A.Sc., Bank of Commerce Bldg., Nanaimo, B. C., Canada, Public Health Nurse, Nanaimo and District Public Health Board

Pearl V. Sayles, 632 S. W. Hall St., Portland, Ore., Student, Oregon Medical School

Helen M. Smith, R.N., P. O. Box 644, Seward, Alaska, Public Health Nurse, Territorial Dept. of Health

Clarice R. B. Spindle, B.S., 407 City Hall, Charleston, W. Va., Director-Supervisor, Charleston Public Health Nursing Assoc.

Bertha M. Tiber, B.S., Box 2822, Juneau, Alaska, Supervisor of Nurses, Alaska Office of Indian Affairs

Mildred I. Udgaard, B.A., 1221 Willard, Ann Arbor, Mich., Postgraduate course in Public Health, University of Michigan

Mrs. Alice H. Wasser, 315 E. 77 St., New York, N. Y., Staff Nurse, Assoc. for Improving the Condition of the Poor

Epidemiology Section

Dorland J. Davis, B.S., 615 N. Wolfe St., Baltimore, Md., Rockefeller Foundation Fellow studying at Johns Hopkins School of Hygiene and Public Health

Jack C. Haldeman, M.D., Territorial Dept. of Health, Juneau, Alaska, Tuberculosis Clinician

Viola M. Vreeland, R.N., 38 Foote Ave., Pittsfield, Mass., Follow-up Worker of Gonorrhea and Syphilis, Berkshire County House of Mercy Hospital and Fairview Hospital, Great Barrington

Unaffiliated

Frederick J. Adams, B. Arch., 77 Massachusetts Ave., Cambridge, Mass., Associate Professor of City Planning, Massachusetts Institute of Technology

Charles W. Beasley, M.D., Lyndon, Kans., Osage County Health Officer

Claire D. Hopper, M.D., Whiterocks, Utah, Field Physician, U. S. Indian Service

Edward A. Piszczek, M.D., 14 Ivy St., Boston, Mass., Student, Harvard School of Public Health

Geneve G. Riefling, D.D.S., 3907 Connecticut St., St. Louis, Mo.

Paul D. Rosahn, M.D., 310 Cedar St., New Haven, Conn.

Gertrude Sturges, M.D., 1313 East 60 St., Chicago, Ill., Consultant on Medical Care, American Public Welfare Assoc.

I. Oscar Weissman, M.D., 55 Shattuck St., Boston, Mass., Student, Harvard School of Public Health

Lillian Wurzel, B.A., 303 State Bldg., San Francisco, Calif., Medical Social Worker, State Dept. of Public Health

NATIONAL HEALTH COUNCIL

AT a recent meeting of the Executive Board, the entire question of continued participation by the American Public Health Association in the activities of the National Health Council was considered, and the Executive Board confirmed the selection and appointment of John A. Ferrell, M.D., Louis I. Dublin, Ph.D., and Reginald M. Atwater, M.D., as delegates to the National Health Council, but on a temporary basis. The Board directed its delegation to inform the National Health Council of its desire for a definite statement as to the present activities of the Council in the field of joint planning and as to any proposed program of action which the Council may have in mind for the immediate future. In making this request the Board indicated that it is not convinced of the desirability of continued membership in the Council.

ASSOCIATION REPRESENTATIVES

CHARLES F. WILINSKY, M.D., Director of Beth Israel Hospital, Boston, has been reappointed liaison officer between the A.P.H.A. and the American Hospital Association.

W. S. LEATHERS, M.D., Dean of Vanderbilt University School of Medicine, Nashville, Tenn., has been appointed as Association representative to the meeting of the Advisory Council on Medical Education, Licensure and Hospitals, held in Chicago, February 12 and 13.

EMPLOYMENT SERVICE

The Employment Service will register persons qualified in the public health field without charge.

Replies to these advertisements, indicating clearly the key number on the envelope, should be addressed to the American Public Health Association, 50 West 50th Street, New York, N. Y.

POSITIONS AVAILABLE

WANTED—(a) Student health physician; state university; some teaching; opportunity graduate training. (b) College nurse; state teachers' college; college degree required; $125, maintenance; southeast. (c) Public health nurse; some administrative duties; municipal department of health; middle-west. (d) Public health nurse; to supervise outpatient department, children's hospital; some teaching duties. WRITE: 339, Medical Bureau, Pittsfield Building, Chicago, Ill.

POSITIONS WANTED

HEALTH OFFICERS

(a) Public health physician desires connection; M.D., Virginia; several years' successful private practice; 10 years' public health work during which time he has been promoted continuously; excellent reason for relocating. (b) Health educator; A.B., Wellesley; M.S. in public health from state university; 6 years, teaching physiology and sciences in public schools; 2 years, director of child health education, national organization; 2 years, health counselor and teacher of health education, midwest metropolis; 4 years' social work. For further details, please write M. Burneice Larson, Director, Medical Bureau, Pittsfield Building, Chicago, Ill.

Unusually well qualified and experienced administrator, M.D., Johns Hopkins, M.P.H., Harvard, with broad experience in administering programs of medical care, is available. **A404**

Experienced public health executive; 10 years as full-time county health officer; 4 years as state commissioner of health, wishes administrative position of responsibility. **A403**

Physician, M.D., Syracuse University; postgraduate studies in bacteriology and immunology, will consider position as health officer or epidemiologist. Has served as

EMPLOYMENT SERVICE (Cont.)

POSITIONS WANTED (Cont.)

director of county health unit, director of industrial hygiene and medical statistics and venereal disease field survey officer. **A305**

Physician, M.D., Class A medical school; M.P.H., Harvard School of Public Health; extensive experience in pediatrics and school medical services; also background of county health administration and teaching in medical school, will consider expanded opportunity in teaching or research. **A302**

Experienced physician, administrator, epidemiologist, and teacher, now employed, with C.P.H. from Johns Hopkins, and 14 years' public health background, will consider position. Prefers epidemiology in city or state department. Excellent references. **A355**

Physician, M.D., Columbia, experienced as county health officer and superintendent of health, seeks position in public health administration or medical executive work. **A396**

Physician, M.D., St. Louis University; now completing M.S.P.H., University of Michigan; 10 years' experience as county and city health officer, seeks full-time public health administrative position. **A373**

Physician with M.P.H. from Harvard, experienced as epidemiologist and in county health administration, also in communicable diseases at state level, seeks responsible position. **A392**

Physician, M.D., Class A medical school; M.S.P.H., University of Michigan, 1937; now serving as district state health officer, seeks full-time city or city-county administrative position. **A367**

Physician, M.D., Vanderbilt University; Dr.P.H., Johns Hopkins; experienced as epidemiologist, health officer and professor of preventive medicine, seeks position as administrator or epidemiologist. **A397**

Physician, M.D., University of Cincinnati; with postgraduate training in venereal disease control, Johns Hopkins; now employed, is available as venereal disease control officer. A363

HEALTH EDUCATION

Experienced teacher in public health and author; M.A., Columbia; now teaching public health nursing and carrying field promotion, wishes broader opportunity to train field personnel in extending health knowledge and interest to the general public, especially through group education, institutes, exhibits and rural programs. **H400**

Well qualified woman in health education wishes position as health coördinator or health counselor. Has wide experience, and Ph.D. from New York University. **H236**

Young woman, experienced teacher in health education, with M.S. in Public Health and Hygiene from University of Michigan, seeks position as health coördinator. **H398**

LABORATORY

Laboratory technician, B.Sc. degree; with experience in Army, state public health laboratory and U. S. Public Health Service field laboratory, seeks position in medical school or university. **L379**

Woman bacteriologist; B.A., Chemistry, 1933; 5 years' experience in experimental and practical therapeutics including animal work; desires position in public health field. **L394**

Bacteriologist and pathologist with wide administrative experience; Ph.D., Brown University, will consider leading position in this field. **L371**

MISCELLANEOUS

Medical social worker, graduate of Tulane University, with 18 years' hospital experience, is available for position; especially interested in programs of public medical care. **B401**

Experienced teacher of bacteriology and hygiene; M.D., University of Pennsylvania; excellent connections, wishes to secure teaching position. **M402**

NEWS FROM THE FIELD

NEW YORK UNIVERSITY INSTRUCTION IN PREVENTIVE MEDICINE

A NEW program for instruction in preventive medicine for medical students has been announced by Dr. Currier McEwan, Dean of New York University School of Medicine, made possible by a grant of $84,000 from the Commonwealth Fund. The new arrangement will comprise studies covering the entire four year period and will be centered around the Department of Preventive Medicine and the Hermann M. Biggs professorship in preventive medicine. Dr. Harry Stoll Mustard, Director of the Department, will be in charge of the program and it will be conducted by a full-time staff of instructors and technicians. Rather than to concentrate studies in preventive medicine on the last two years of the regular medical college work, it will now begin in the freshman year and will include activities at a teaching and research center provided in the facilities of the lower East Side Health District, the use of which has been made possible through the coöperation of the New York City Department of Health.

NATIONAL SOCIETY FOR PREVENTION OF BLINDNESS

THE National Society for the Prevention of Blindness has announced that Lewis H. Carris, managing director, assumed the title of general director on January 1, with Mrs. Winifred Hathaway as associate director.

Eleanor Brown Merrill, an associate director for the past five years and formerly secretary of the Society, becomes executive director, and will relieve Mr. Carris of administrative details.

John M. Glenn, one of the founders of the National Society for the Prevention of Blindness, has been elected an honorary vice-president.

COLORADO PUBLIC HEALTH ASSOCIATION

OFFICERS of the Colorado Public Health Association for 1939 are announced as follows:

Amos L. Beaghler, M.D., *President*
Roy L. Cleere, M.D., *Vice-President*
Helen Cannon, *Secretary*
Omer R. Gillett, M.D., *Treasurer*

UNIVERSITY OF MINNESOTA FELLOWSHIPS

THE University of Minnesota has announced a limited number of in-service fellowships in Public Administration for the academic year 1939–1940. The period of training will extend from the beginning of the fall term through the first term of the summer session, and individual courses of study will be planned for each student depending upon previous preparation, personal interests and the requirements of public service. These in-service fellowships will carry stipends varying in amount from $1,000 to $1,500 a year, depending upon the student's experience, his present salary and the number of his dependents. Credit earned in residence at the University during the training period may be applied toward advanced degrees.

Applications for these fellowships for the academic year 1939–1940 are to be submitted not later than April 1, 1939, to the Secretary of the Committee on Training for Public Administration, 13 University Library, University of Minnesota, Minneapolis. Those applicants employed in such functional departments as health and sanitation should have had at least a minimum of preparation in political science and other social sciences. Each applicant must be endorsed by his governmental employer and should secure promise of a leave of absence for the duration of his fellowship year.

VACCINES FOR CHINA

THE Chronicle of the Health Organization, League of Nations, Geneva, reports that in 1938 the Chinese health authorities, faced with the threat of a cholera epidemic, asked the League to supply them with six million doses of vaccines. With the generous support of 13 countries, including the United States, the Health Organization succeeded in less than 4 weeks in procuring eight million doses free of charge.

In thanking the countries concerned, the Council of the League drew special attention to this striking example of the part which the League of Nations can play in the field of international humanitarian assistance.

NORTH CAROLINA SYMPOSIUM ON SYPHILIS

IT is announced that a Symposium on Syphilis will be held at Duke University, Durham, N. C., March 24–25. This symposium is being sponsored by the North Carolina State Board of Health and Duke University.

The following speakers have been scheduled: Dr. Thomas Parran, Dr. John H. Stokes, Dr. J. Earl Moore, Dr. H. N. Cole, Dr. Paul O'Leary, Dr. P. C. Jeans, Dr. Norman R. Ingraham, Dr. Carl V. Reynolds, and Dr. William deB. MacNider.

HONOLULU MENTAL HYGIENE CLINIC

A CLINIC for mental hygiene was recently established in Honolulu to serve the Territory of Hawaii. Dr. Franklin G. Ebaugh, of Denver, Colo., supervised the organization.

A unit at Queens Hospital has been given over to the clinic to provide hospitalization and treatment facilities. Dr. Edwin E. McNeil, of New York, was to take charge of the clinic October 18. Steps were recently taken to initiate mobile mental hygiene clinics to serve these islands.

LOS ANGELES HEALTH DEPARTMENT FILM

THE Los Angeles City Health Department has ventured into a new field, as part of its recent annual report. It has recently completed a motion picture, 45 minutes in length, which shows in detail the functions of its various departments.

The film is divided into three reels, as follows: Reel I, Division of Public Health Education; Library; Division of Laboratories; Epidemiology — Quarantine—District Doctors. Reel II, Women's Venereal Diseases; Men's Venereal Diseases; Tuberculosis Division; Nursing Division; Child Hygiene; Housing and Sanitation Division. Reel III, Meat Division; Fruit and Vegetable Division; Rodent Division. A brief statistical summary is given with each division.

NEW YORK TUBERCULOSIS ASSOCIATION MEETING

THE annual meeting of the New York Tuberculosis and Health Association and of the Tuberculosis Sanatorium Conference of Metropolitan New York will be held at the Hotel Pennsylvania, New York, N. Y., March 2. The morning session will be under the auspices of the Sanatorium Conference, Dr. Foster Murray, Chairman, presiding.

"The National Health Program" will be discussed at the luncheon session, held under the auspices of the New York Tuberculosis and Health Association, Dr. I. Ogden Woodruff, President, presiding. Dr. Abel Wolman, President of the American Public Health Association, will discuss the extent and magnitude of the national health program, and Dr. George Baehr, Chairman of the Public Health Relations Committee of the New York Academy of Medicine, will give the viewpoint of the practising physician.

HOSPITALIZATION INSURANCE IN THE UNITED STATES

THE American Hospital Association has announced that almost three million persons in the United States are participating in non-profit hospitalization insurance. Predicting that 500,000 hospital bills, totaling $25,000,000, would be paid by non-profit organizations during 1939 to the 600 member hospitals throughout the nation, C. Rufus Rorem, Ph.D., of Chicago, announced that the number of participants had increased 100 per cent during 1938.

DISPOSAL OF OIL-FIELD BRINES

AS a feature of its study of the disposal of oil-field brines, the Bureau of Mines, U. S. Department of the Interior, has just published a report on the construction of seven typical oil-field brine-conditioning plants and their operation in preparing brines for subsurface disposal. The investigation is being conducted in coöperation with the Kansas State Board of Health. Such oil-field brines constitute a source of pollution of water supplies.

One of the major problems in the underground disposal of oil-field brines is the clogging of the subsurface formation in the disposal well by suspended matter in the brines. Pretreatment of brines and subsequent subsurface disposal still remain in the experimental stages due to technical and economic problems involved. Consequently numerous types of brine-conditioning systems and methods of brine treatment attaining varying degrees of success have been developed by entering streams draining oil field areas and by passing into shallow water brining formations which may be used as sources of private and public water supply.

These studies, by Sam S. Taylor, C. J. Wilhelm, and W. C. Holliman, have been published as Report of Investigations 3434, "Typical Oil-field Brine-Conditioning Systems: Preparing Brine for Subsurface Injection." Copies are available without charge upon request from the Bureau of Mines, Washington, D. C.

A.I.C.P. GUIDES FOR NURSES

THE Guides for Public Health Nurses in the Family Health Series, published by the Association for Improving the Condition of the Poor, New York, have been revised.

The A.I.C.P. announces the following Guides for the use of nurses employed by them:

No. 1. Child Developmnet
No. 2. Syphilis
No. 3. Tuberculosis
No. 4. Cardiac Conditions
No. 5. Posture

The price is 5 cents each on quantities up to 100, and 4 cents on orders over 100 (plus postage). Address orders to the A.I.C.P., 105 East 22nd Street, New York, N. Y.

MOBILE X-RAY UNIT FOR VIRGINIA

THE Virginia State Department of Health recently purchased a new mobile X-ray unit because of the increasing demand for X-ray service in rural areas.

The truck provides facilities for taking chest pictures, developing films and making the information immediately available to local physicians who have referred the patients to the clinic.

RESPIRATORS FOR BRITISH HOSPITALS

ANNOUNCEMENT has been made that every hospital in the British Empire will be equipped with a respirator. These iron lungs will be furnished by Lord Nuffield, British motor manufacturer and philanthropist, who will turn over one of his factories to the manufacture of this equipment, which he plans to deliver to the hospitals free of charge.

PERSONALS

Central States

CLIFFORD H. GREVES,† of the University of Michigan, Ann Arbor, Mich., has been appointed Venereal Disease Statistician to the Michigan Department of Health in Ann Arbor.

DOROTHY ROOD, R.N., PH.D.,† of Columbus, Ohio, who has been in charge of the courses in Public Health Nursing at Ohio State University for the past 3 years, has been appointed Director of Public Health Nursing for Loyola University, Chicago, Ill. Her work will be in connection with that of EARL E. KLEINSCHMIDT, M.D., DR.P.H.,† the Director of the Department of Preventive Medicine, Public Health and Bacteriology in the School of Medicine.

Eastern States

DAVID B. AST, D.D.S.,† has been appointed Assistant Director for Oral Hygiene, in the Division of Maternity, Infancy and Child Hygiene, of the New York State Department of Health, Albany, N. Y.

DR. HELEN BALDWIN has been appointed Health Officer of Canterbury, Conn.

DR. SAMUEL S. FARAGO, of Westerly, R. I., has been appointed Health Officer of Pawcatuck, Conn., succeeding the late DR. WILLIAM A. HILLARD.

DR. CHARLES FLYNN is now Acting Health Officer of Hamden, Conn., succeeding DR. GEORGE H. JOSLIN.†

EDWARD S. GODFREY, JR., M.D.,* Albany, N. Y., has been reappointed for a term of 4 years as Commissioner of Health of New York State.

GEORGE C. SHATTUCK, M.D.,† has been promoted from Assistant Professor to Clinical Professor of Tropical Medicine, in the Harvard Medical School and the Harvard School of Public Health, Boston, Mass.

Southern States

HENRY F. BUETTNER, M.D., of the Baltimore City Health Department, was promoted to the position of full-time Medical Health Officer. Since 1922, he has been instructor in bacteriology and immunology in the University of Maryland Medical School.

DR. HUGH G. CLARK, of Lafayette, Ala., has been appointed Health Officer of Chambers County, succeeding DR. ABRAHAM I. PERLEY, who was awarded a year's graduate study at Harvard University.

DR. JACK A. CRITTENDEN, of Elba, Ala., has been appointed Health Officer of Coffee County, succeeding DR. WILLIAM A. DODSON, JR., who resigned on account of ill health.

GRADY F. MATHEWS, M.D.,† of Tahlequah, Okla., has been appointed State Commissioner of Health of Oklahoma, succeeding Charles M. Pearce, M.D. Dr. Mathews since 1936 has been full-time Health Officer in a 5-county health district in Oklahoma. He is a graduate of the University of Oklahoma and has studied at the Johns Hopkins School of Hygiene and Public Health.

G. FOARD MCGINNES, M.D., DR.P.H.,* has resigned as Director of the Bureau of Communicable Diseases in the Virginia State Department of Health to accept a position in Memphis, Tenn., as Director of the Venereal Disease Demonstration Project. Dr. McGinnes will also serve as Associate Professor of the University of Tennessee, and as Consultant with the Tennessee State Health Department and the U. S. Public Health Service.

DONALD B. MCMULLEN, D.Sc., Head of the Biology Department, Monmouth College, Monmouth, Ill., has been appointed Assistant Professor

* Fellow A.P.H.A.
† Member A.P.H.A.

of Bacteriology, in charge of the Division of Parasitology, University of Oklahoma School of Medicine, Oklahoma City, Okla.

FRED L. MOORE, M.D., C.P.H.,† who for 11 years has been County Health Officer of Sullivan County, Blountville, Tenn., has resigned to become Associate Professor in the Department of Preventive Medicine and Community Health of the Long Island College of Medicine, Brooklyn, N. Y.

J. W. ROY NORTON, M.D., M.P.H.,* of Chapel Hill, N. C., Assistant Director of Preventive Medicine of the North Carolina State Board of Health, has been appointed Professor of Public Health Administration in the Division of Public Health, University of North Carolina School of Medicine.

DR. MARTLE F. PARKER, of Greenville, Ala., has been named Health Officer of Butler County, to succeed DR. CHARLES J. FISHER, who is taking graduate work at the Johns Hopkins School of Hygiene and Public Health, Baltimore.

Western States

MARION W. CASKEY, M.D., PH.D.,† of Lewiston, Idaho, has resigned as Health Officer of the North Central Idaho Health District, composed of Nez Perce, Latah, and Clearwater Counties.

DR. JOHN R. CORKERY, JR., has resigned as Health Officer of Spokane, Wash., to engage in private practice.

CHARLES L. COYLE, M.D.,† formerly of Marshfield, Ore., has resigned as Health Officer of Coos County, to engage in private practice in Grants Pass.

DR. FRED CHARLES HARVEY has been appointed Health Officer of Spokane, Wash., succeeding DR. JOHN R. CORKERY, resigned.

DR. RICHARD N. SHERWIN, of St. Helens, Ore., has been appointed Health Officer of Washington County, succeeding DR. DANIEL C. MCDONALD, of Hillsboro, Ore., resigned.

Canada

A. J. DOUGLAS, M.D.,* Chief Medical Health Officer of Winnipeg, Canada, will retire April 1, after almost 39 years as head of the city Health Department.

LASSALLE LABERGE, M.D., of Montreal, Que., was recently appointed Director of the Tuberculosis Division of the Ministry of Health of the Province of Quebec.

DEATHS

J. TREICHLER BUTZ, M.D., D.D.S.,* City Health Officer of Allentown, Pa., died December 22. Dr. Butz was a member of the A.P.H.A. for more than 20 years, and in 1922 was elected a Charter Fellow of the Health Officers Section. He was also a Life Member of the Association, having been elected in 1934.

DR. MATHEW J. SHIELDS, of Scranton, Pa., died January 23, at the age of 76. He served with the Red Cross as a Red Cross first aid instructor from February, 1909, until his retirement in June, 1936. In 1909 he was commissioned a first lieutenant in the Medical Reserve Corps, later serving as captain in the Medical Corps during the World War. In 1924 he was made a lieutenant colonel in the same service.

LUCY P. SUTTON, M.D.,† Associate Professor of Pediatrics at New York University, New York, N. Y., died in December.

---

* Fellow A.P.H.A.
† Member A.P.H.A.

CONFERENCES AND DATES

American Association for Social Security. New York, N. Y. April 7–8.

American Association of Anatomists. Boston, Mass. April 6–8.

American Association of Pathologists and Bacteriologists. Richmond, Va. April 6–7.

American College of Physicians—23rd Annual Session. Municipal Auditorium, New Orleans, La. March 27–31.

American Congress on Obstetrics and Gynecology—sponsored by the American Committee on Maternal Welfare, Inc. Municipal Auditorium, Cleveland, Ohio. September 11–15.

American Library Association. San Francisco, Calif. June 18–24.

American Medical Association, 90th Annual Meeting. St. Louis, Mo. May 15–19.

American Public Welfare Association. Buffalo, N. Y. June 20–22.

American Society of Civil Engineers—Spring: Chattanooga, Tenn., April 19–22. Summer: San Francisco, Calif., July 26–29. Fall: New York, N. Y., September 4–9.

American Statistical Association—Annual Meeting. Philadelphia, Pa. December 27–30.

American Water Works Association—59th Annual Meeting. Ambassador Hotel, Chelsea Hotel, Atlantic City, N. J. June 11–15.

New York Section. Sagamore Hotel, Rochester, N. Y. March 30–31.

Kentucky-Tennessee Section. Peabody Hotel, Memphis, Tenn. April 10–12.

Canadian Section. Royal York Hotel, Toronto, Ont. April 12–14.

Montana Section (following School for Water Works Operators, April 12–13). Park Hotel, Great Falls, Mont. April 14–15.

Illinois Section. Urbana-Lincoln Hotel, Urbana, Ill. April 20–22.

Indianapolis Section. Antlers Hotel, Indianapolis, Ind. April 25–26.

Ohio Section. Van Cleve Hotel, Dayton, Ohio. April 27–28.

Pacific-Northwest Section. Tacoma, Wash. May 18–20.

Building Officials Conference of America. Detroit, Mich. May 1–5.

Civil Service Assembly—Eastern Regional Conference. Asbury Park, N. J. June 14–17.

Chamber of Commerce of the United States of America—27th Annual Meeting. Washington, D. C. May 1–4.

Connecticut Public Health Association. May.

Florida Public Health Association. Jacksonville, Fla. December, 1939.

International Association of Public Employment Services. New Orleans, La. April 11–13.

International Cancer Congress—Third. Haddon Hall Hotel, Atlantic City, N. J. September 11–16.

International Congress of Microbiology—Third. New York, N. Y. September 2–9.

International Congress of Military Medicine and Pharmacy—Tenth. (First meeting of this Congress, organized at the close of the World War, in the Western Hemisphere.) Washington, D. C. May 7–15.

Michigan Public Health Association. Lansing, Mich. November 8–10.

National Conference of Social Work. Buffalo, N. Y. June 18–24.

National County Officers' Association. Ogden, Utah. July 17–22.

National Education Association, and affiliated organizations. San Francisco, Calif. July 2–6.

New York Tuberculosis and Health Association—Tuberculosis Sanatorium

Conference of Metropolitan New York. Hotel Pennsylvania, New York, N. Y. March 2.

Ohio Federation of Public Health Officials. Columbus, Ohio. April 21.

Smoke Prevention Association. Milwaukee, Wis. June 13–16.

Southern California Public Health Association. Long Beach, Calif. January 24, 1940.

South Carolina Public Health Association. Myrtle Beach, S. C. May 29–31, June 1.

State and Provincial Health Authorities of North America—Annual Meeting. Washington, D. C. April 20–22.

State and Territorial Health Officers Conference with the Surgeon General. Washington, D. C. April 20–22.

Western Branch, A.P.H.A. Tenth Annual Meeting. Hotel Oakland, Oakland, Calif. July 24–26.

FOREIGN

British Congress of Obstetrics and Gynecology—11th. Edinburgh, Scotland. April 4–6.

First Mexican Congress on Undulant Fever. Torreon, Mexico. May.

Fourth International Congress of Comparative Pathology. Three Sections: Human Medicine, Veterinary Medicine, and Phytopathology. Rome. May 15–20.

Fifth National Medical Congress of Uruguay. Montevideo, Uruguay. Summer of 1939.

Royal Sanitary Institute of Great Britain. Scarborough, England. July 3–8.

International Federation for Housing and Town Planning. Stockholm, Sweden, July 5–13.

World Federation of Education Associations, Eighth Biennial Congress. Rio de Janeiro, Brazil. August 6–11. (SS. Rotterdam Summer Cruise to South America: from New York, July 5; from New Orleans, July 10; returning to New York August 27.)

Eighth Pan American Child Congress. San Jose, Costa Rico. August 28–September 4.

International Hospital Congress. Toronto, Ont., Canada. September.

American Hospital Association. Toronto, Ont., Canada. September 25–29.

American College of Hospital Administrators. Toronto, Ont., Canada. September 24–25.

Intergovernmental Conference of American Countries on Rural Hygiene. Mexico City, Mexico. End of 1939 (postponed from November 10, 1938).

New York Hospital Graduate Nurses' Club, 317 West 45th Street, New York, N. Y. Rooms available for women during World's Fair. Times Square location, easily accessible to theatres, shops, and all transportation—on direct route, World's Fair. Moderate prices; restaurant.

Measure, Mix and Feed Chlorine Gas Accurately For Water Works, Swimming Pools, and Sewerage Purification with EVERSON SterElators.

EVERSON SterElators are the best from every standpoint. Dependable, accurate, safe, easy to operate. A wide range of capacities. Priced as low as $475.00. Guaranteed to give complete satisfaction.

SterElators by Everson

Write for Free Bulletin 1014 AJ

EVERSON MFG. CO.

209 W. Huron St. Chicago, U. S. A.

CHILD HEALTH FILMS

Entertaining and Instructive

silent and new sound-on film, with voices as clear as a bell and excellent photography, accepted by health authorities as the greatest health films ever produced. Used by schools, State, County and City Health Departments, Medical and Dental Associations, Tuberculosis Associations, Parent-Teacher Associations, and Dairy Councils. Stresses diet, rest, safety-first, exercise, school nurse, Health Department, school examination, immunization and the tuberculin test, correction of deformed faces and irregular teeth, medical and dental examination, and shows effective habits and way to care for the body, mouth and teeth. Information as to sale or rent from: **Dr. David Bennett Hill, Producer, Salem, Oregon.**